US009441897B2

(12) **United States Patent**
Mather et al.

(10) **Patent No.: US 9,441,897 B2**
(45) **Date of Patent: Sep. 13, 2016**

(54) **SAFETY MECHANISM FOR FIREARM**

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(73) Assignee: **STURM, RUGER & COMPANY, INC.**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/980,563**

(22) Filed: **Dec. 28, 2015**

(65) **Prior Publication Data**

US 2016/0187090 A1 Jun. 30, 2016

Related U.S. Application Data

(60) Provisional application No. 62/096,981, filed on Dec. 26, 2014.

(51) **Int. Cl.**
F41A 17/46 (2006.01)

(52) **U.S. Cl.**
CPC ***F41A 17/46*** (2013.01)

(58) **Field of Classification Search**
CPC F41A 17/46; F41A 17/56; F41A 17/64; F41A 17/00
USPC 42/70.06, 70.01, 70.04, 70.05
See application file for complete search history.

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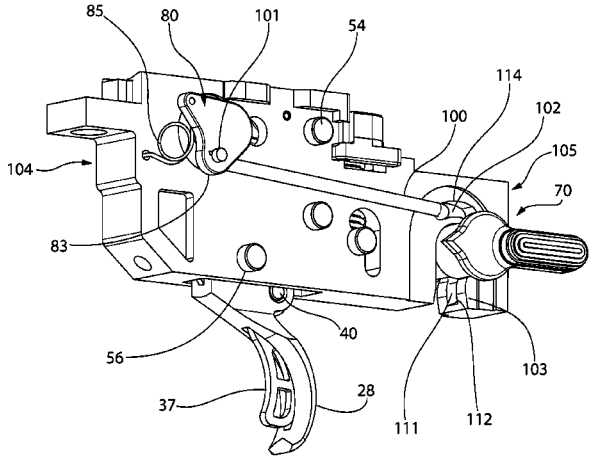
(57) **ABSTRACT**

A bolt action rifle with safety mechanism includes a receiver, barrel coupled to the receiver, and a trigger housing detachably coupled to the receiver. The trigger housing includes a trigger-actuated firing mechanism operable to discharge the rifle. A safety mechanism comprises a safety shaft and safety selector each rotatably mounted in the trigger housing and operably coupled together by a mechanical linkage, such as a rod in one embodiment. The safety selector comprises a control shaft and selector switch for operating the selector. Rotating the safety selector in a first direction rotates and engages the safety shaft with the trigger to disable the firing mechanism. Rotating the safety selector in a second direction rotates and disengages the safety shaft from the trigger to enable the firing mechanism for discharging the rifle. In one embodiment, the safety selector is mounted in a lower stock which includes a pistol grip.

26 Claims, 27 Drawing Sheets



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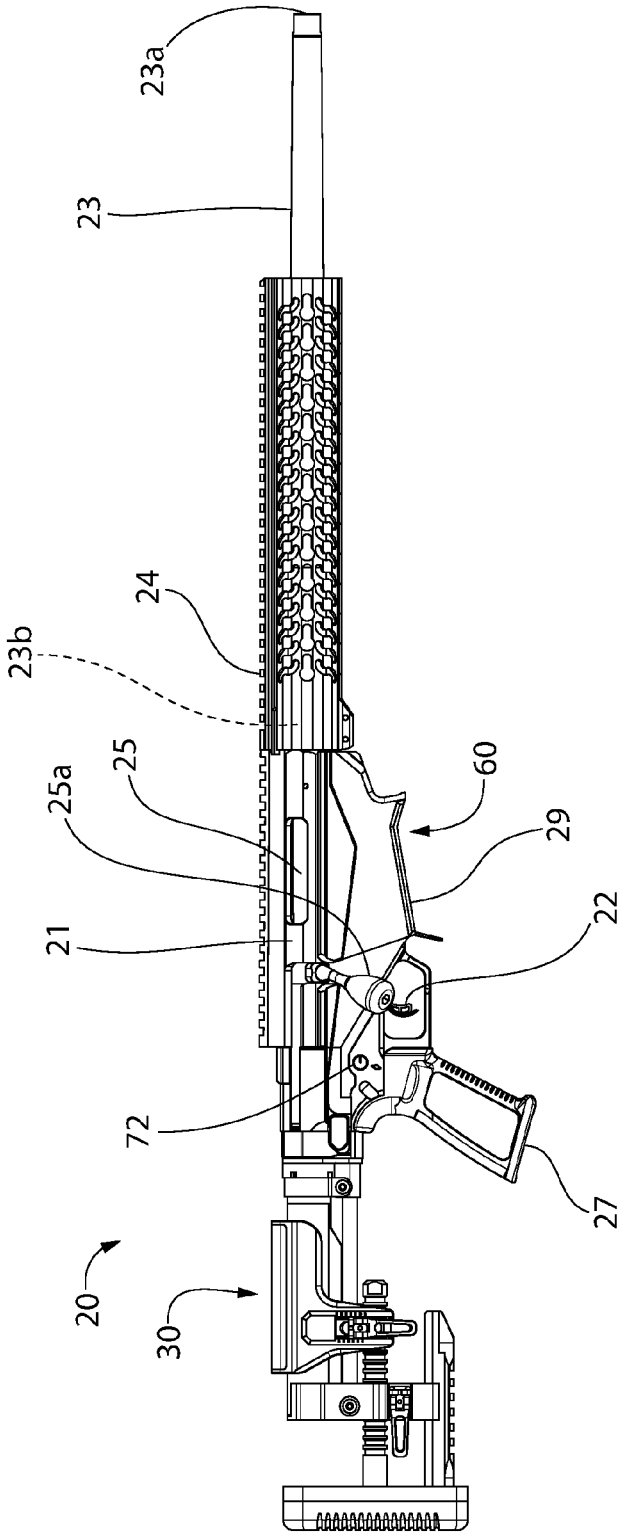

FIG. 1

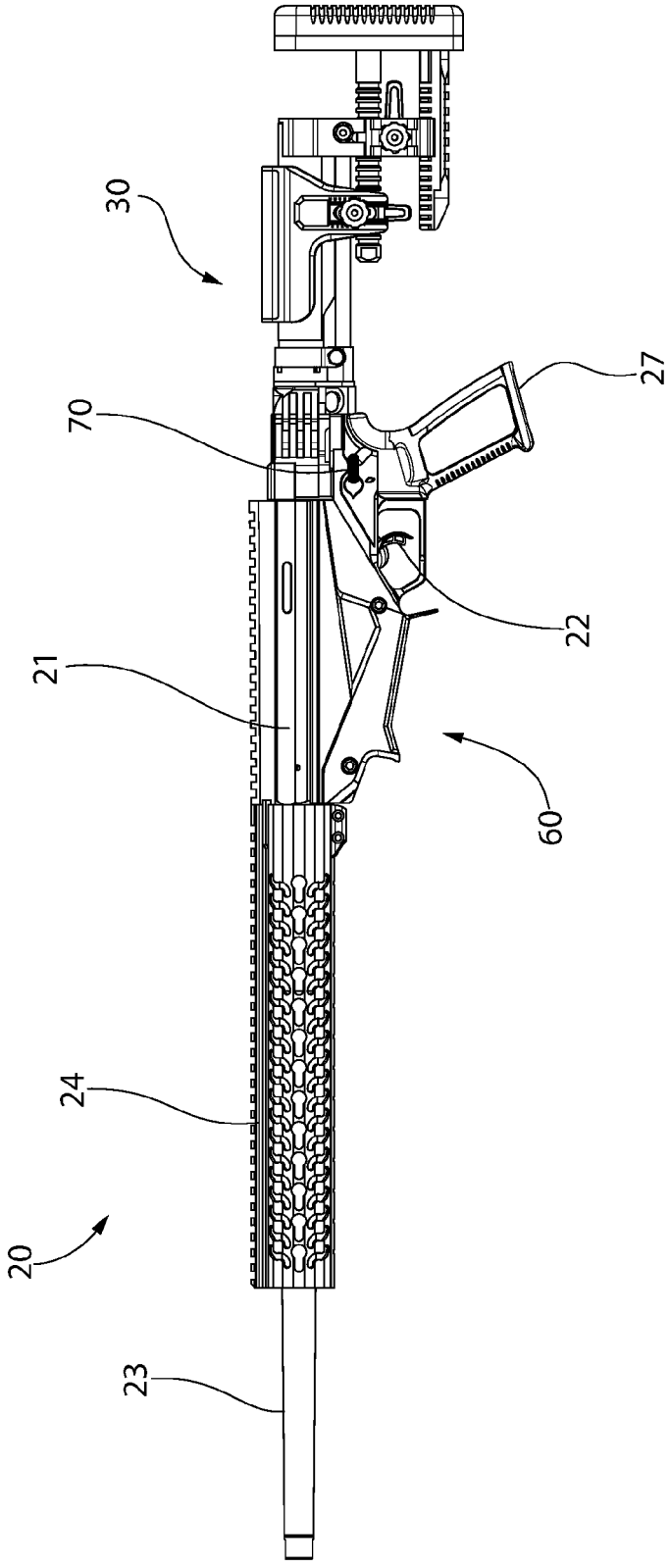

FIG. 2

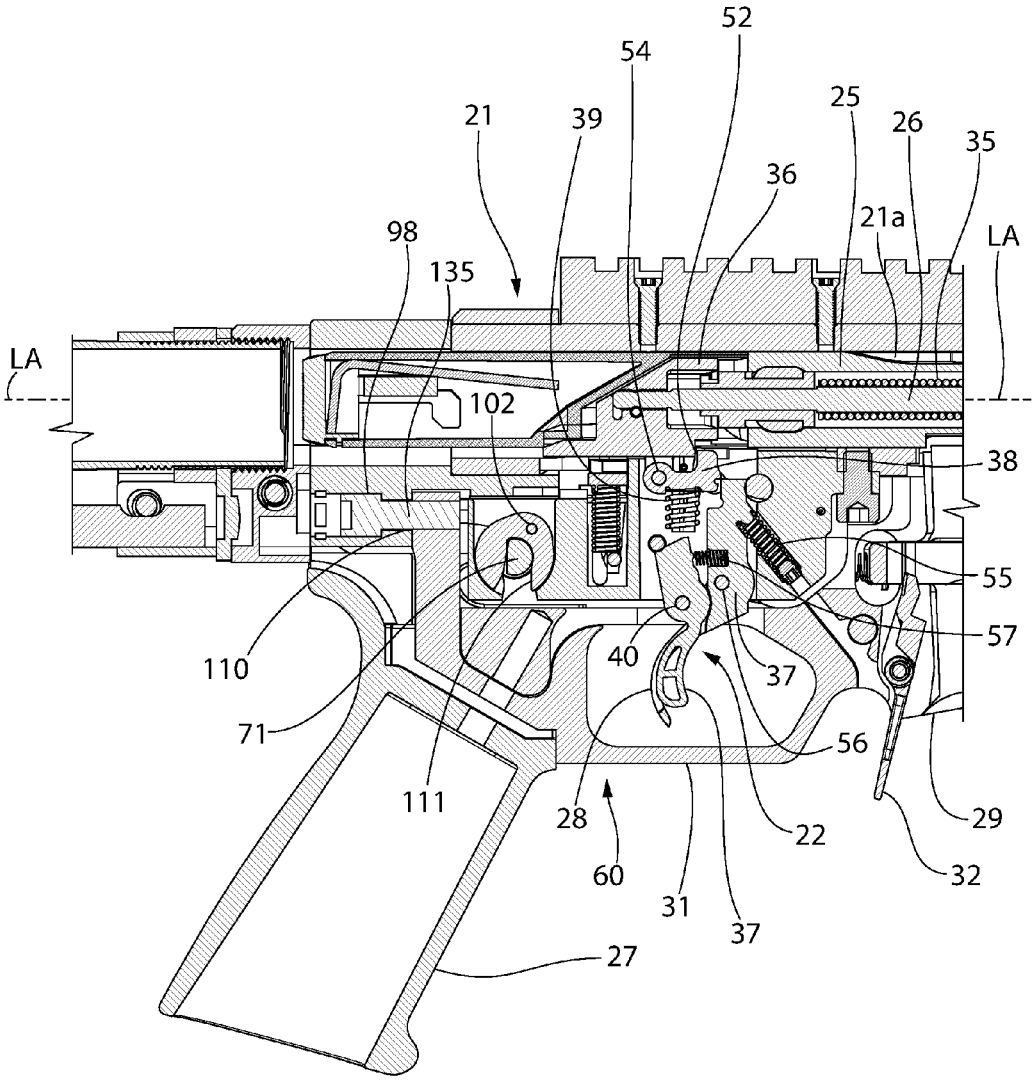
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FIG. 3

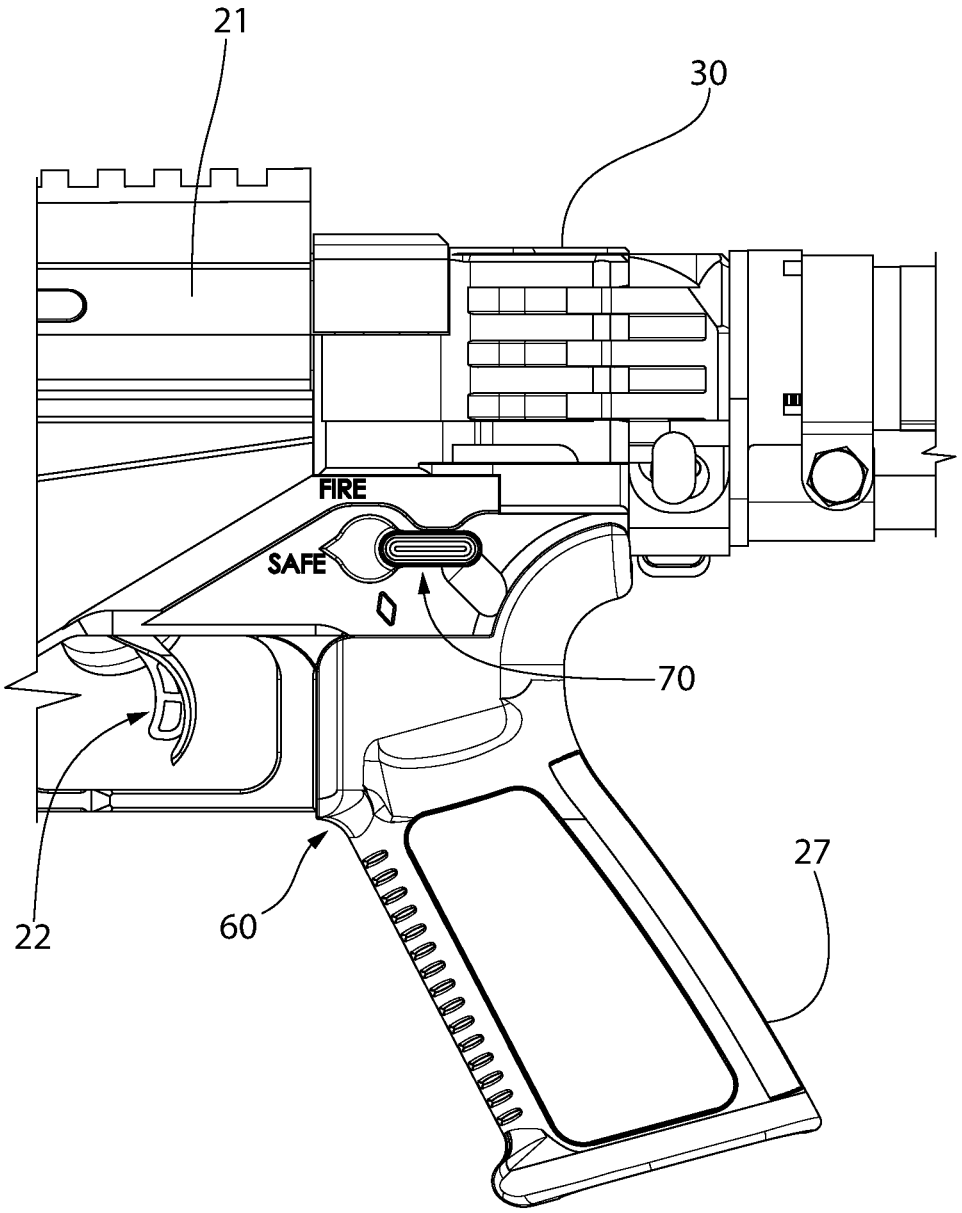

FIG. 4

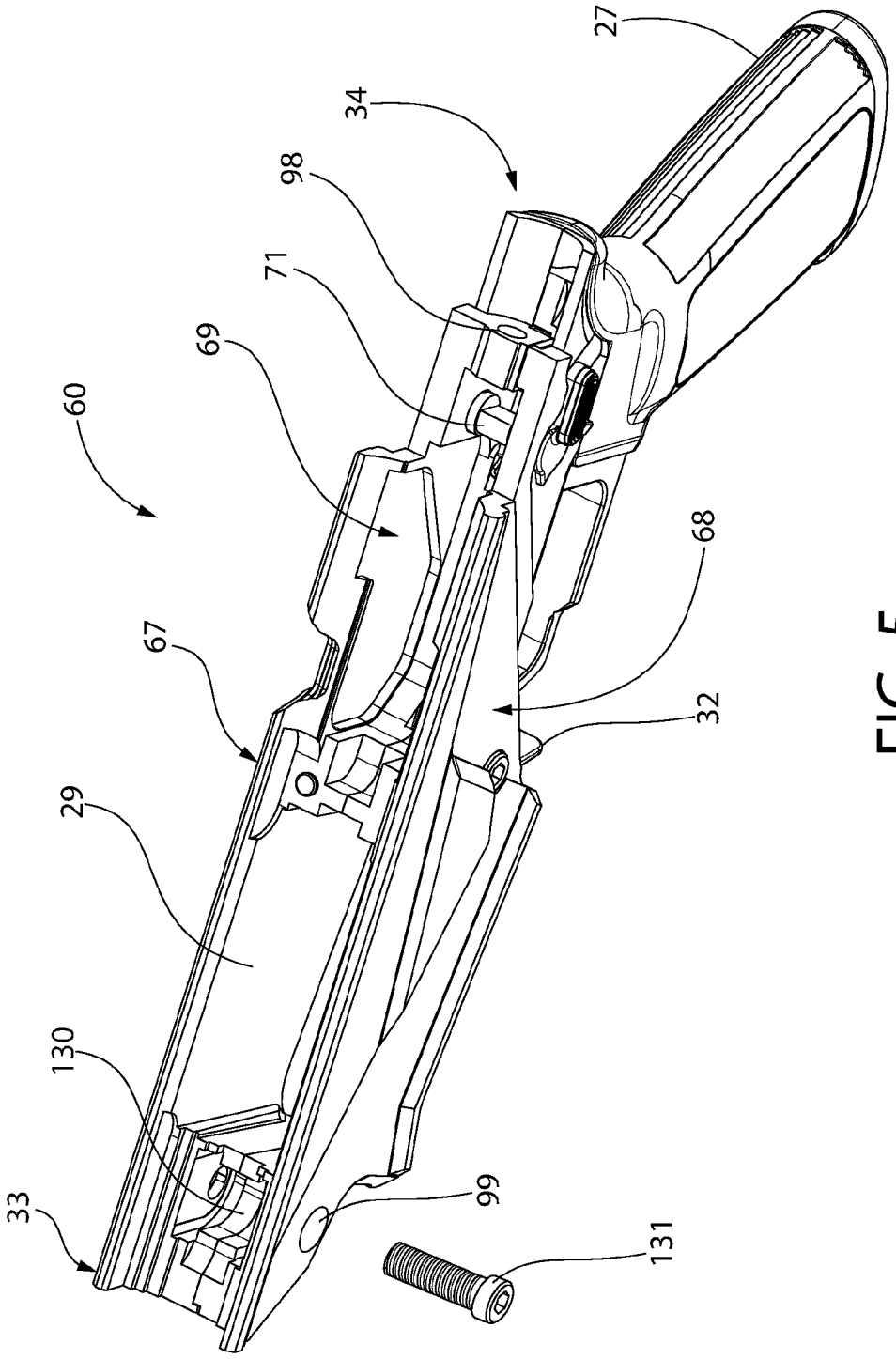

FIG. 5

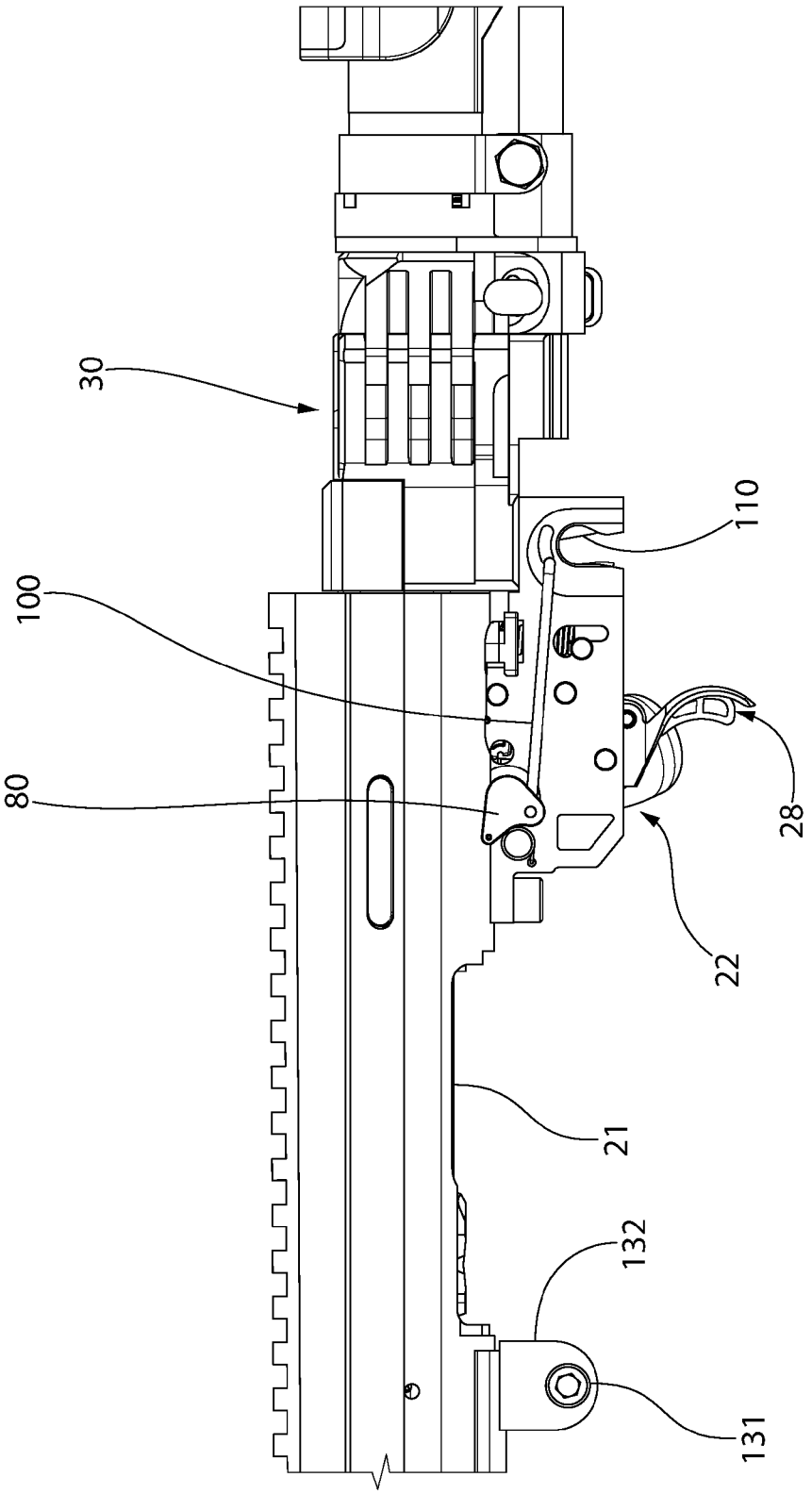

FIG. 6

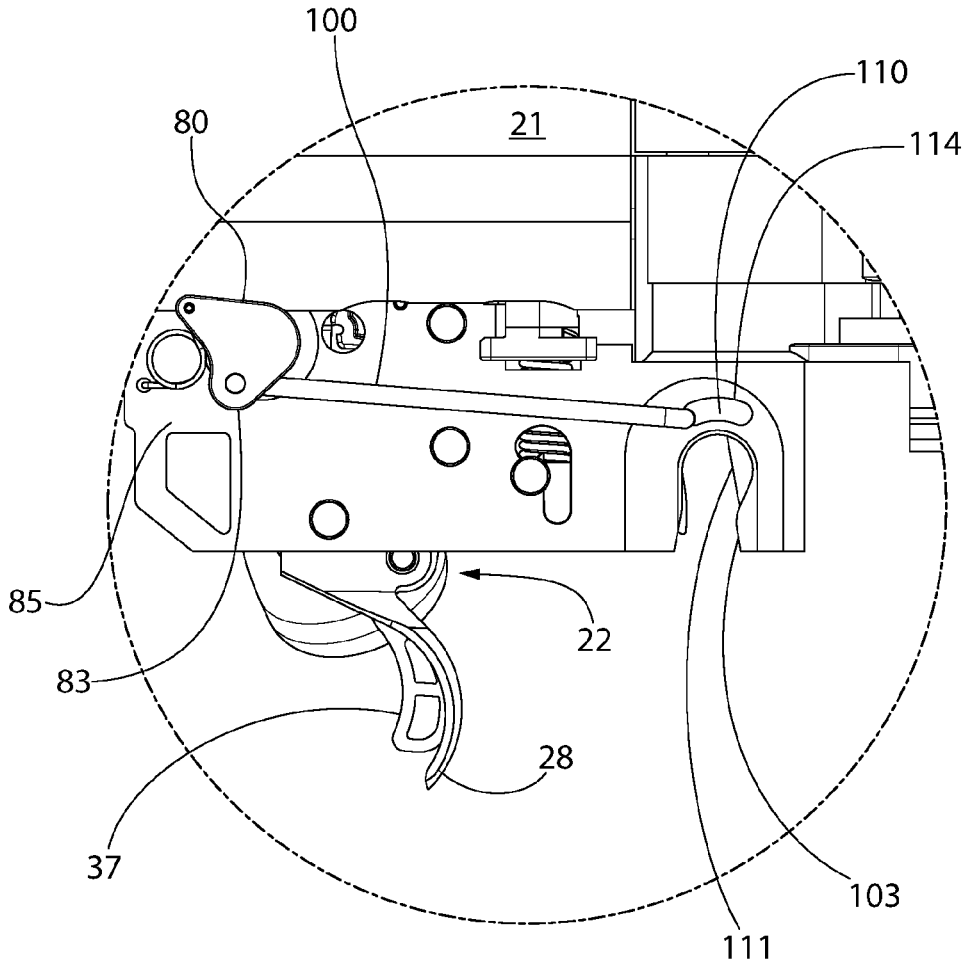

FIG. 7

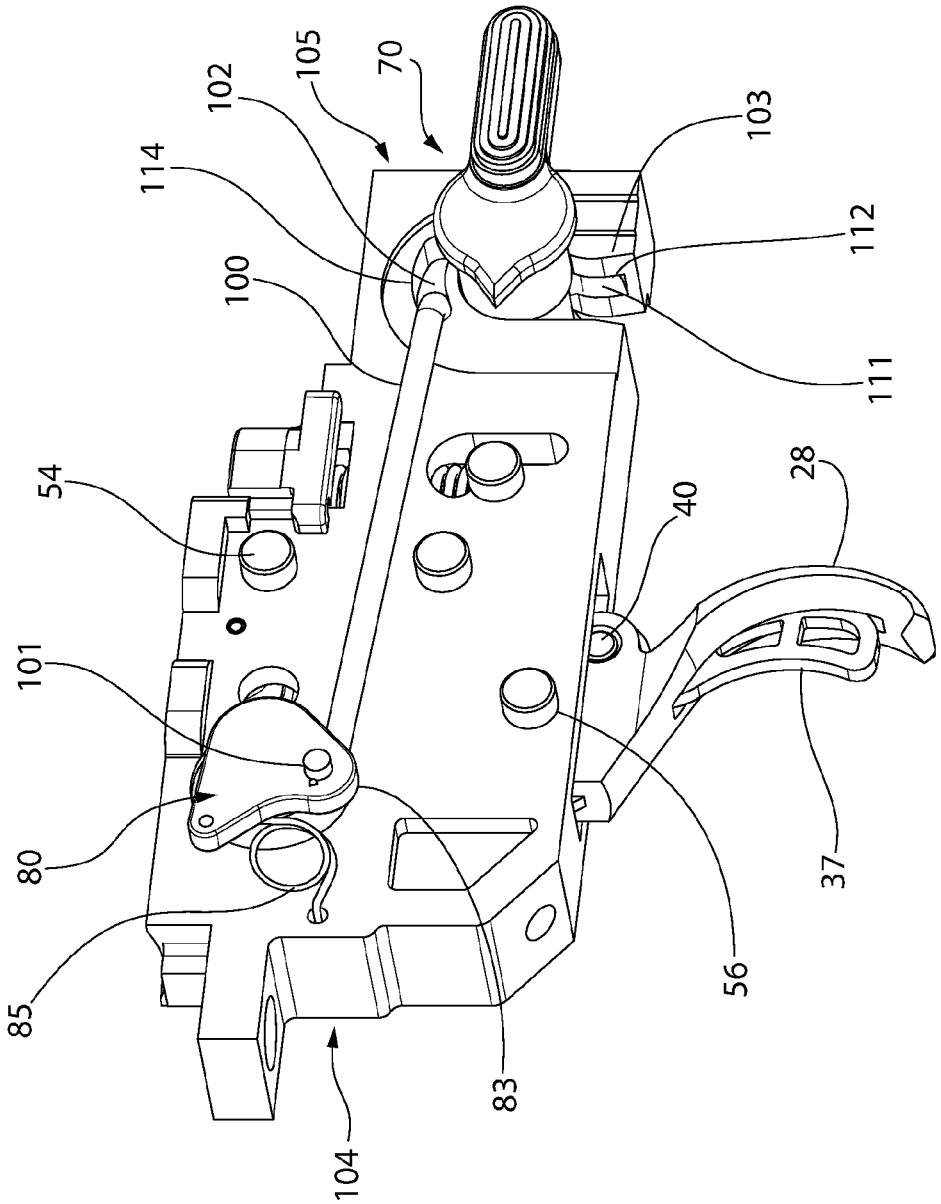

FIG. 8

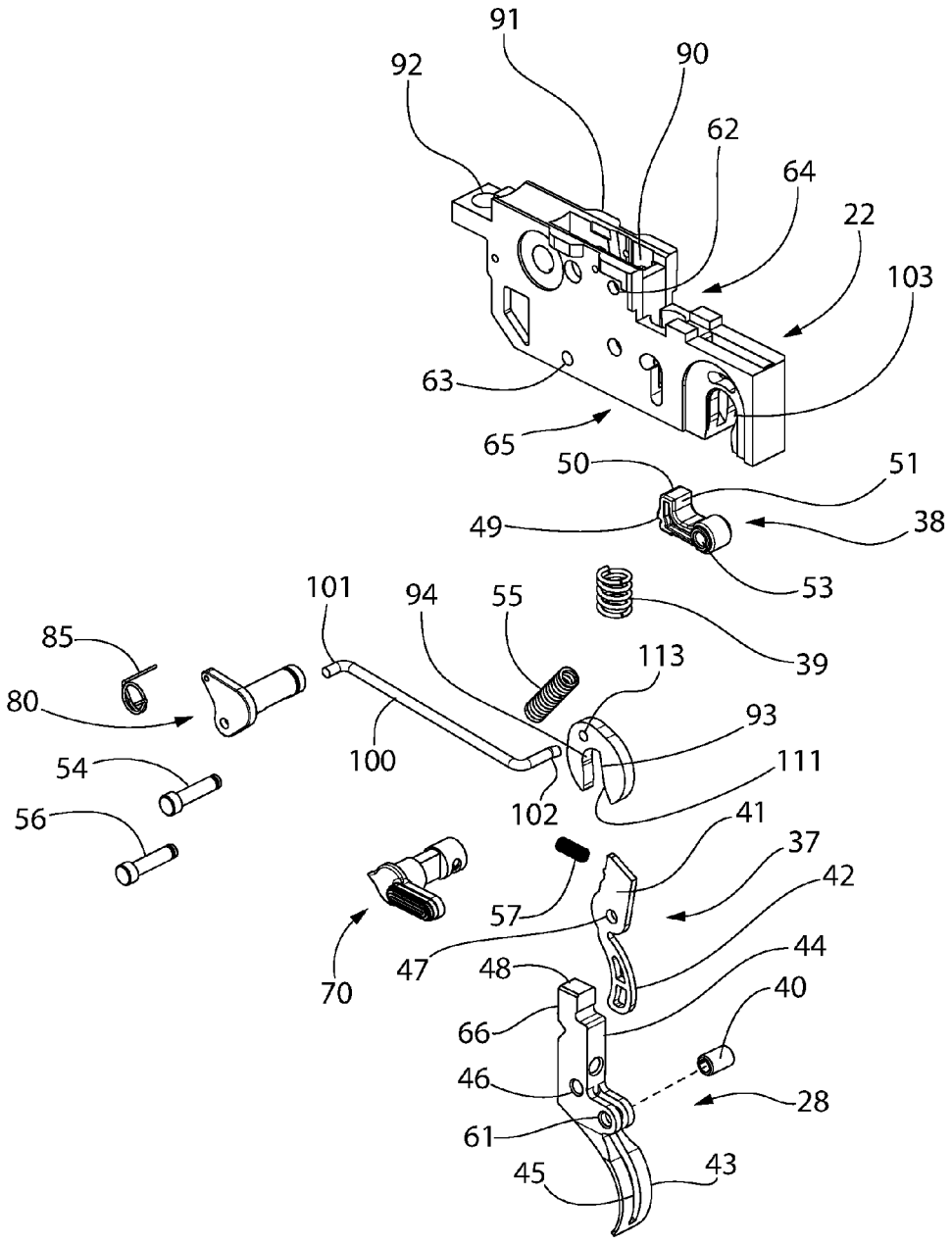
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FIG. 9

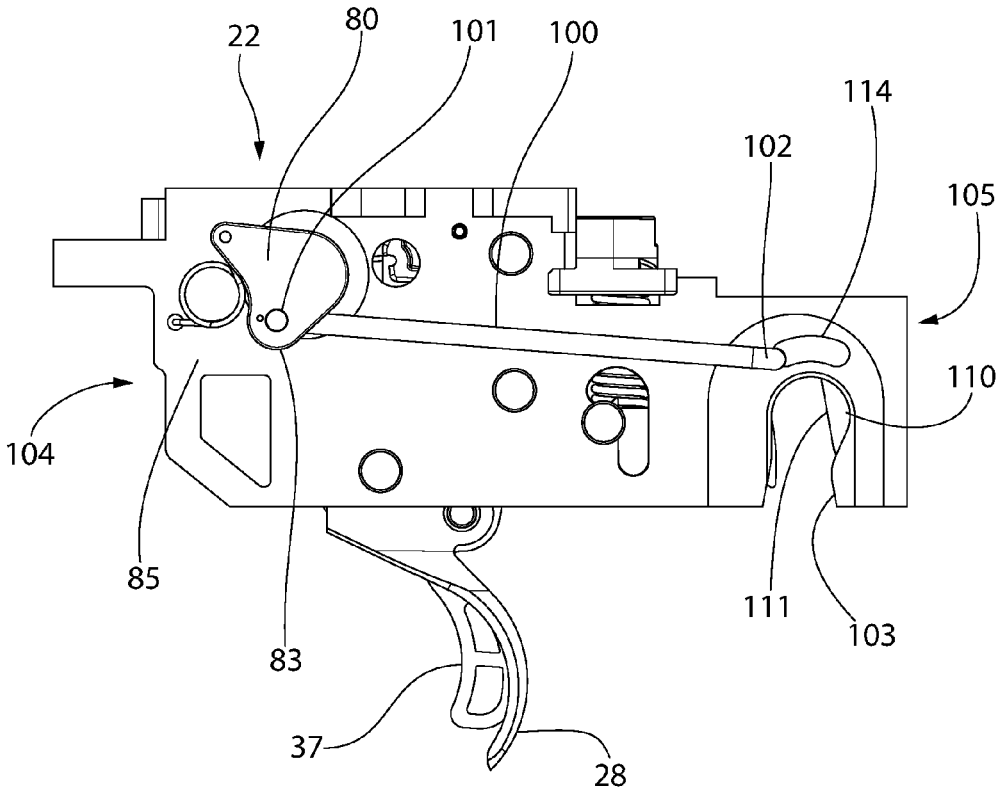


FIG. 10A

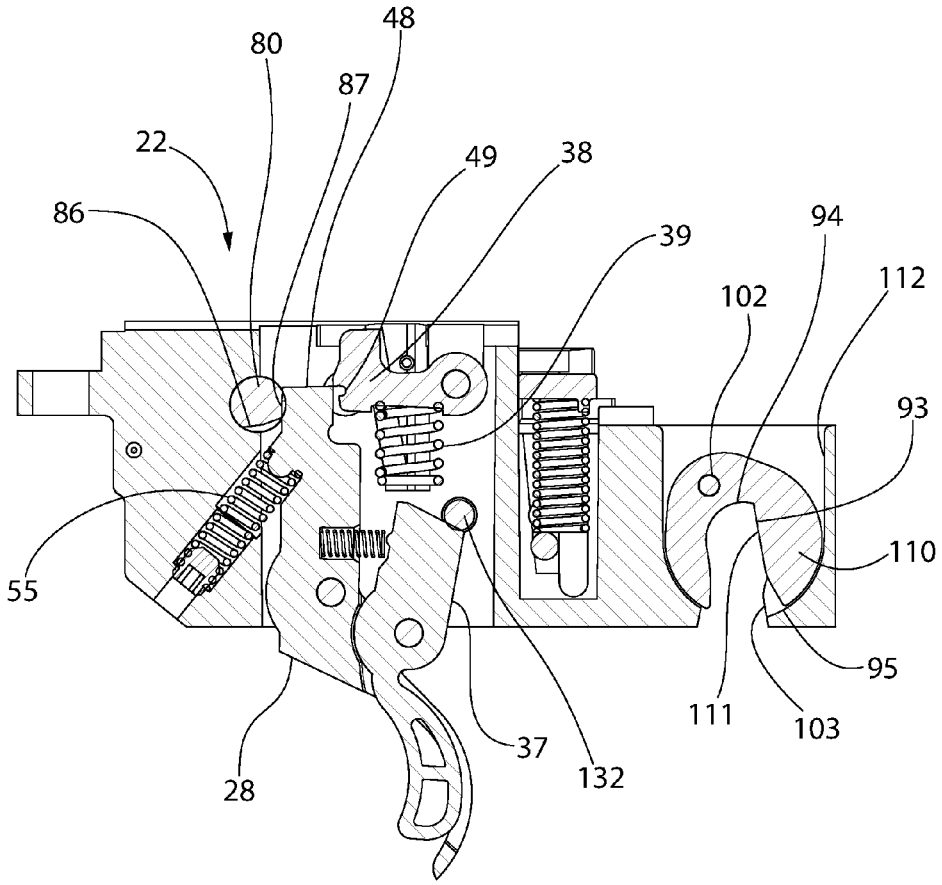


FIG. 10B

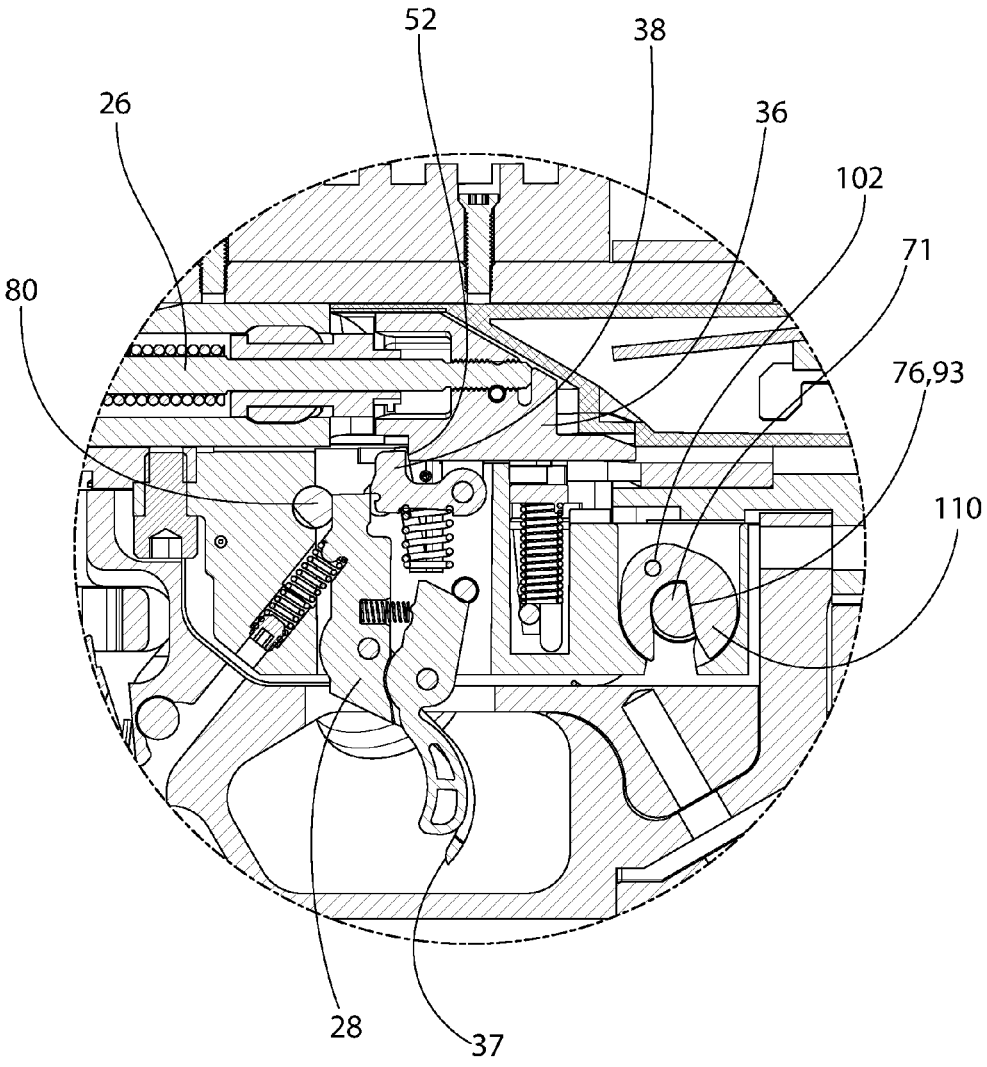


FIG. 10C

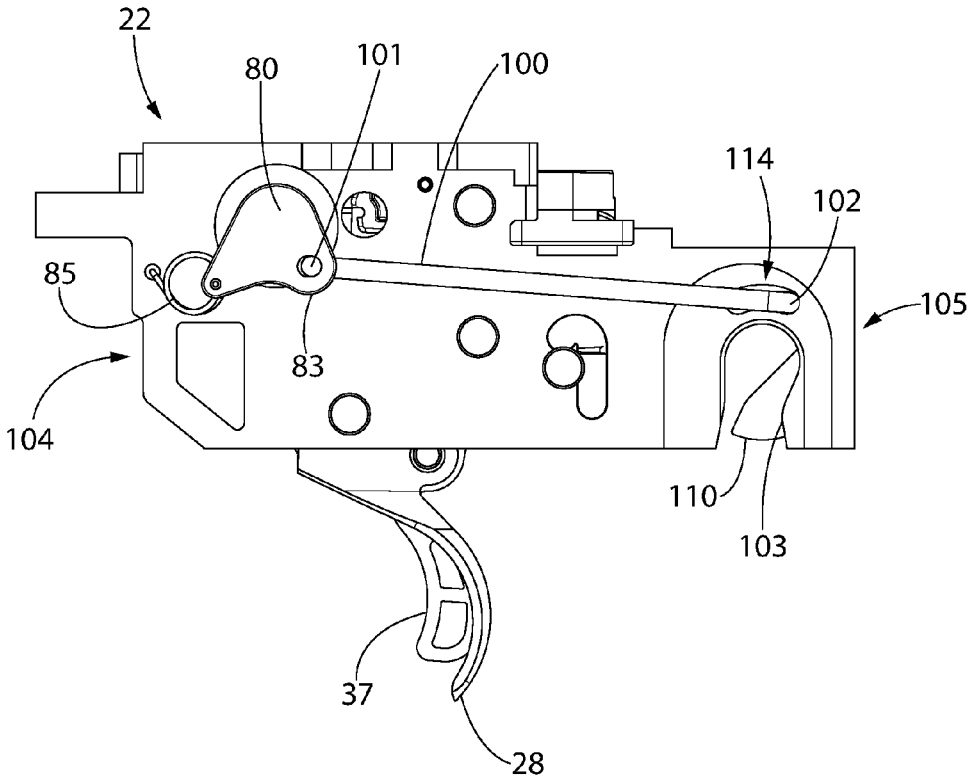


FIG. 11A

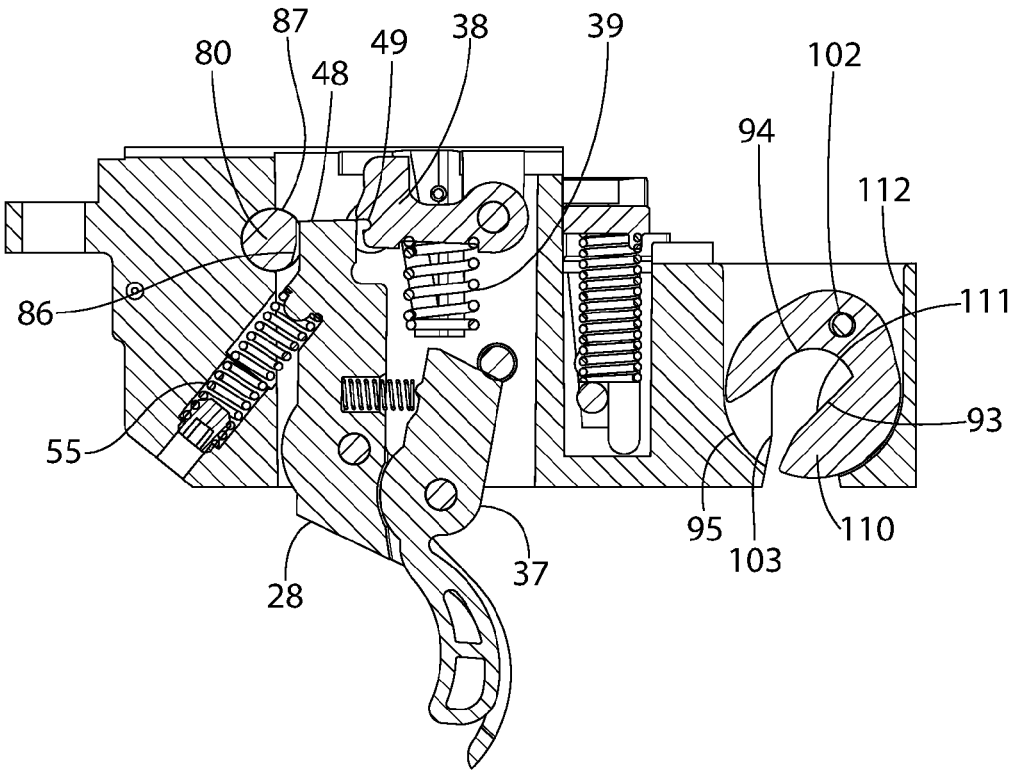


FIG. 11B

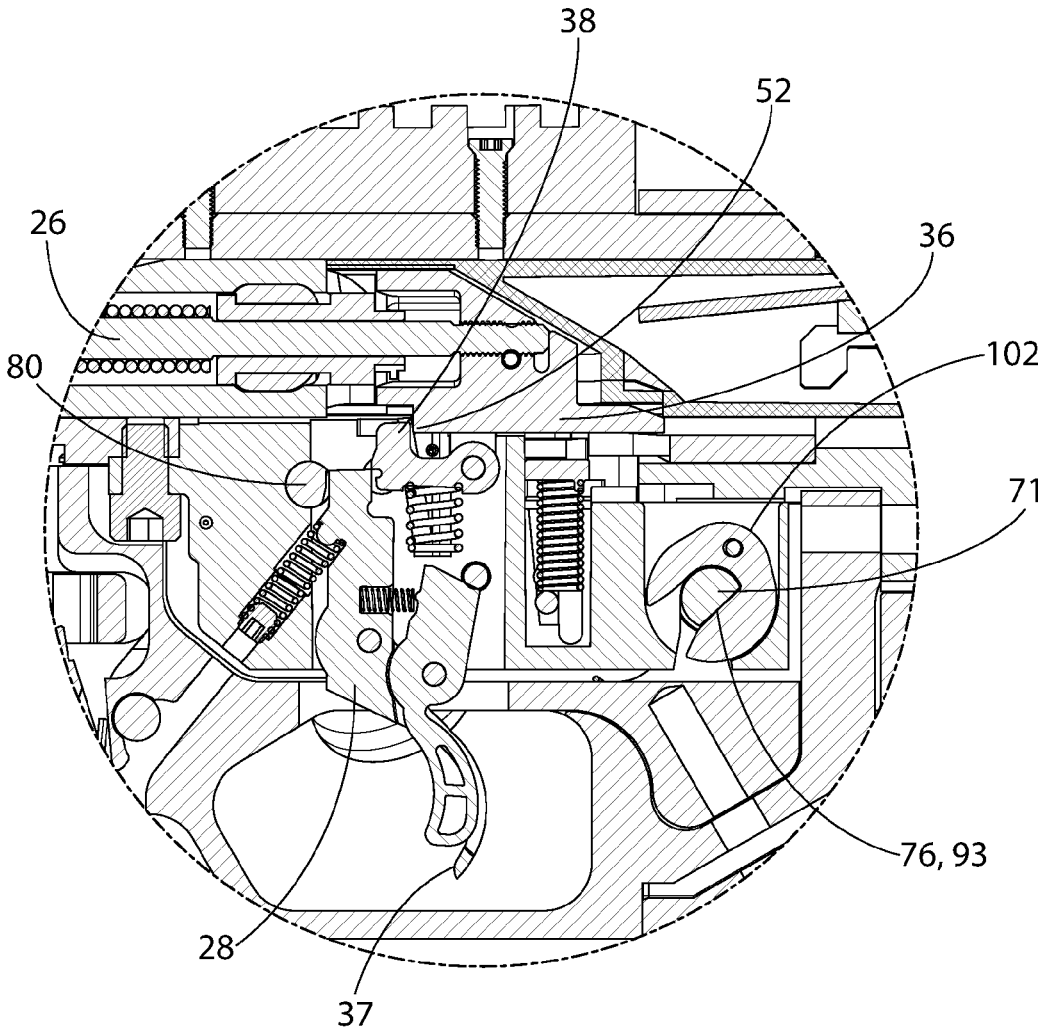


FIG. 11C

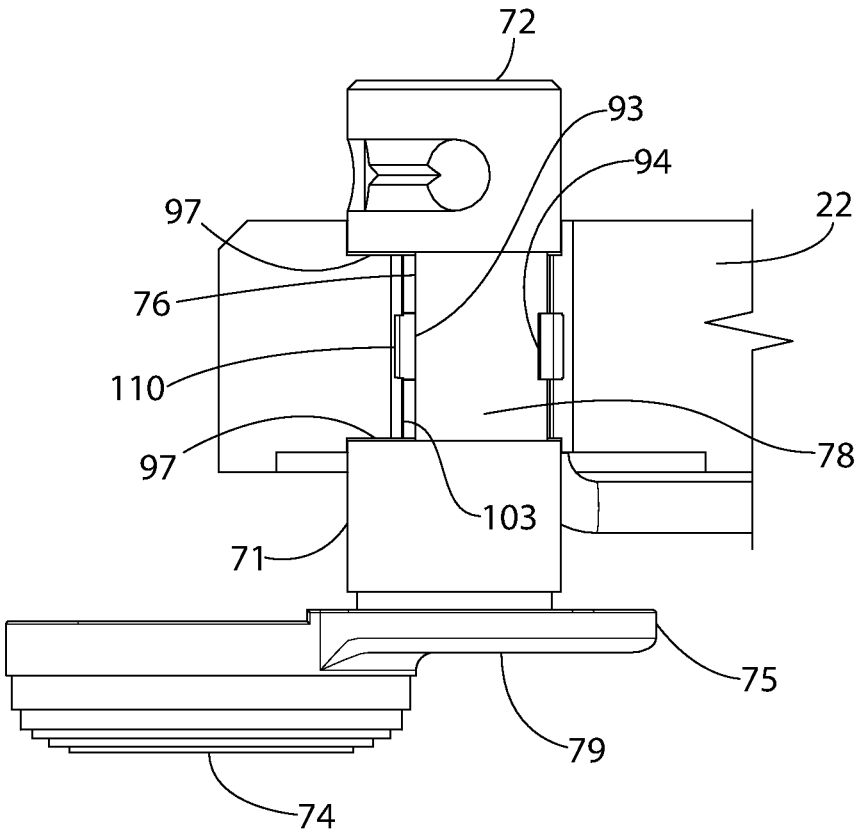
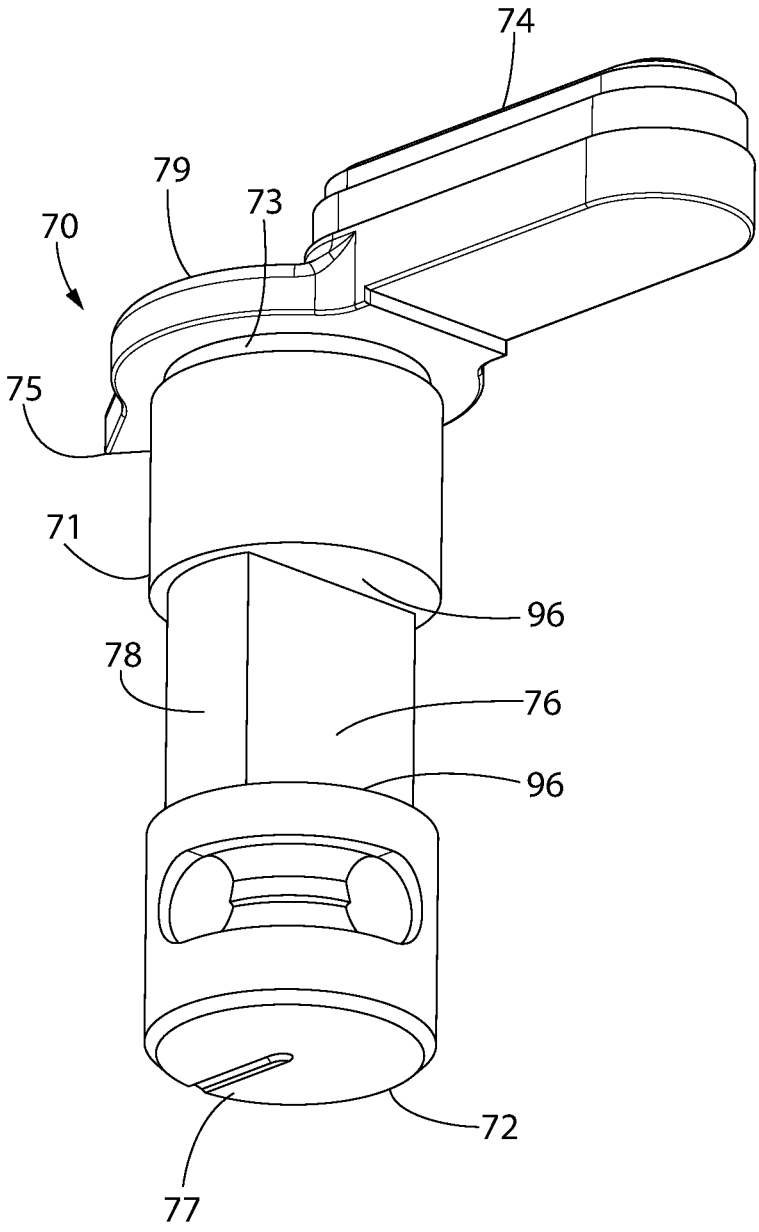


FIG. 12



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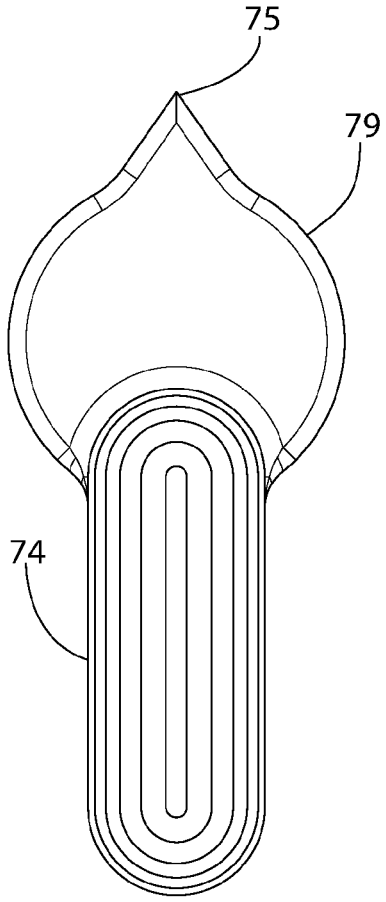


FIG. 14

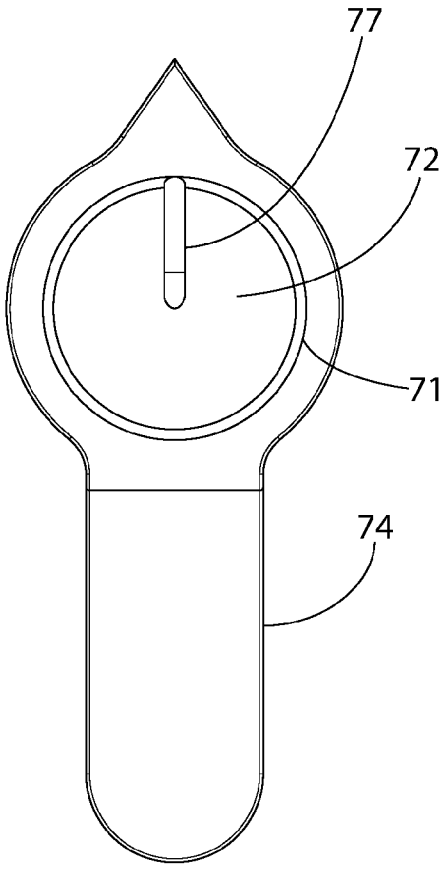


FIG. 15

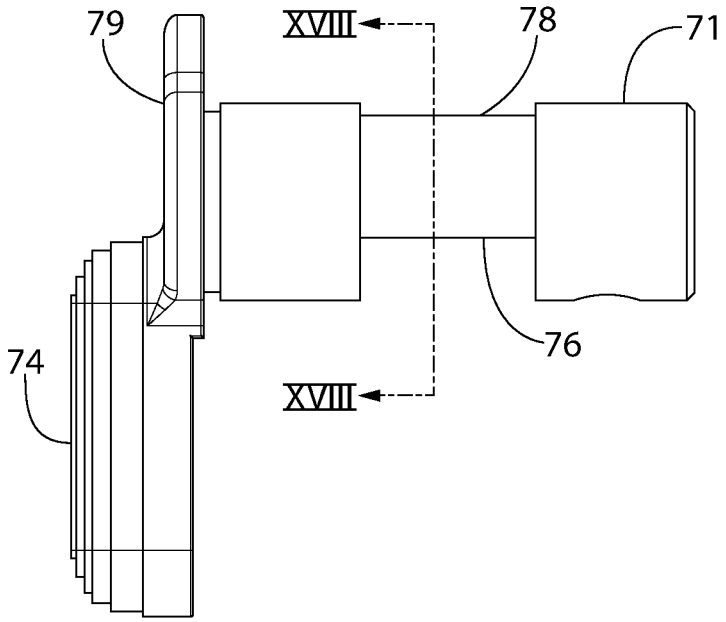


FIG. 16

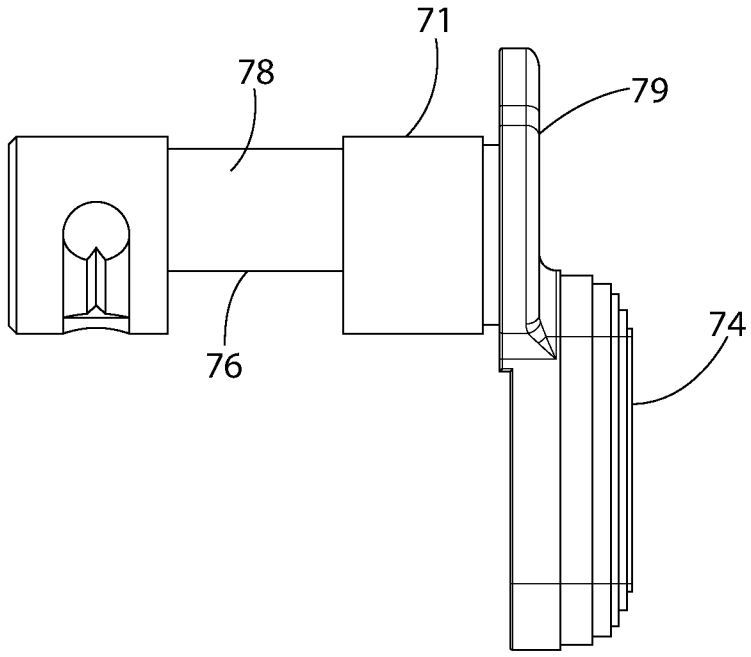


FIG. 17

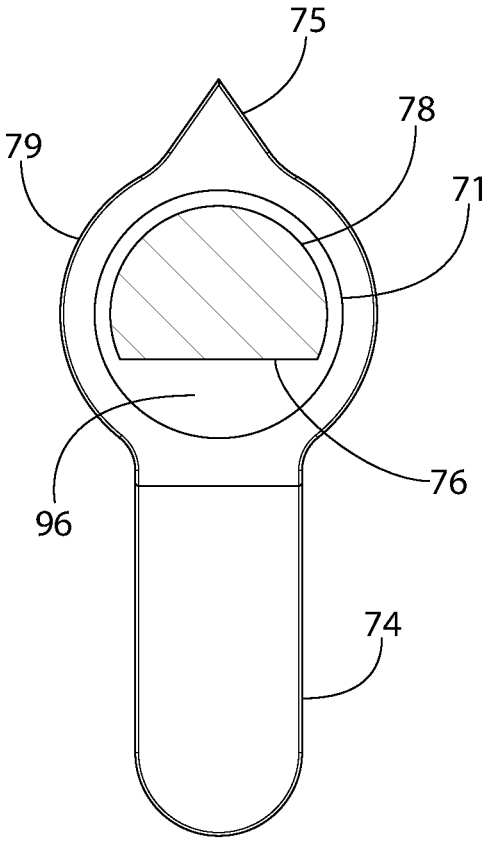


FIG. 18

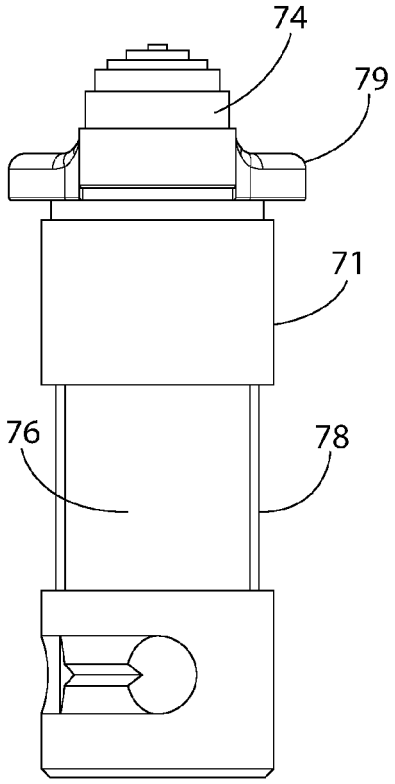


FIG. 19

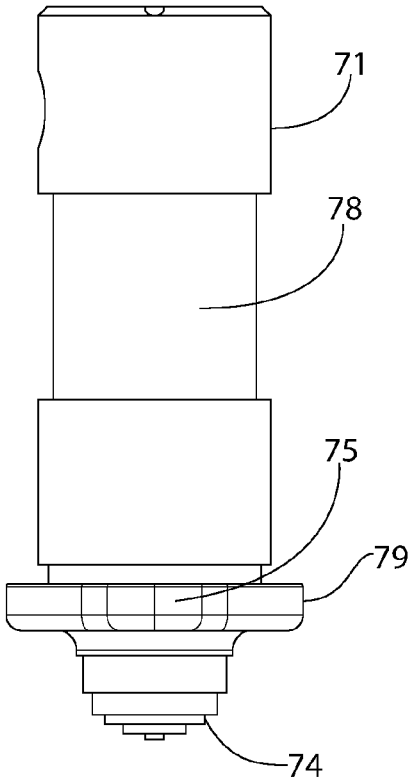


FIG. 20

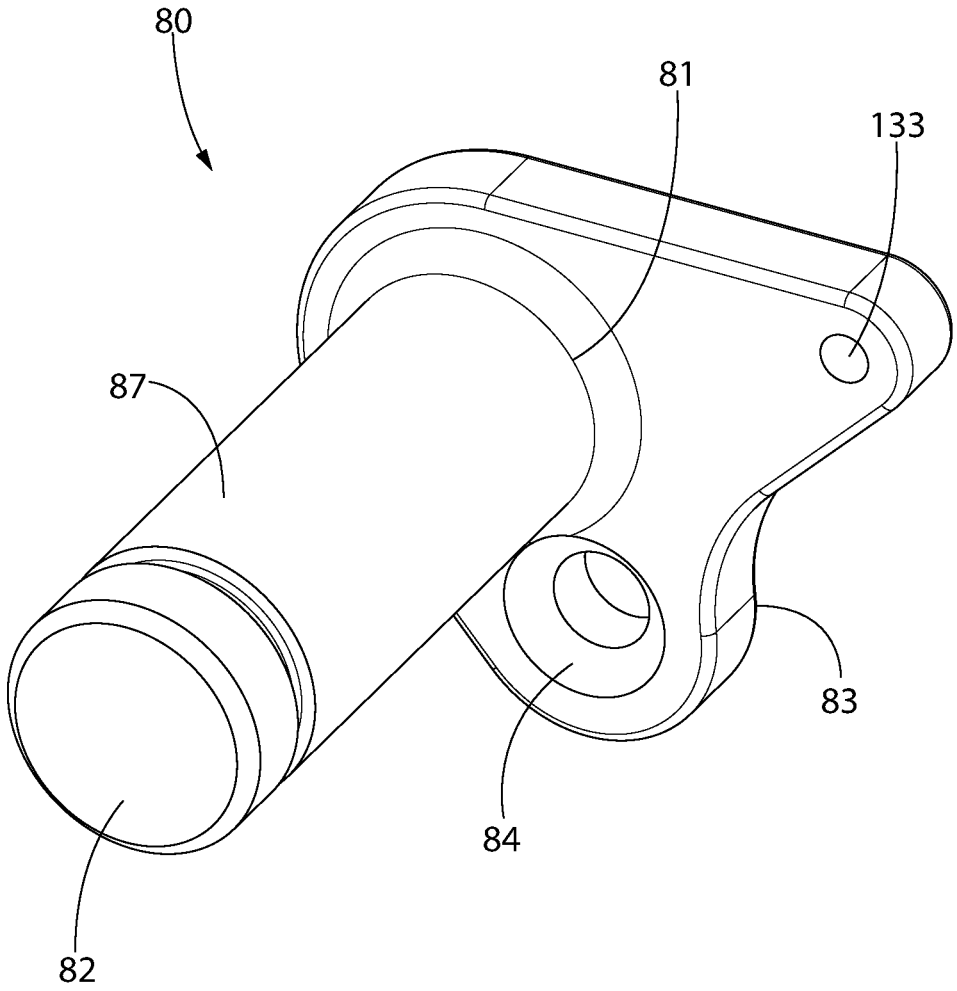


FIG. 21

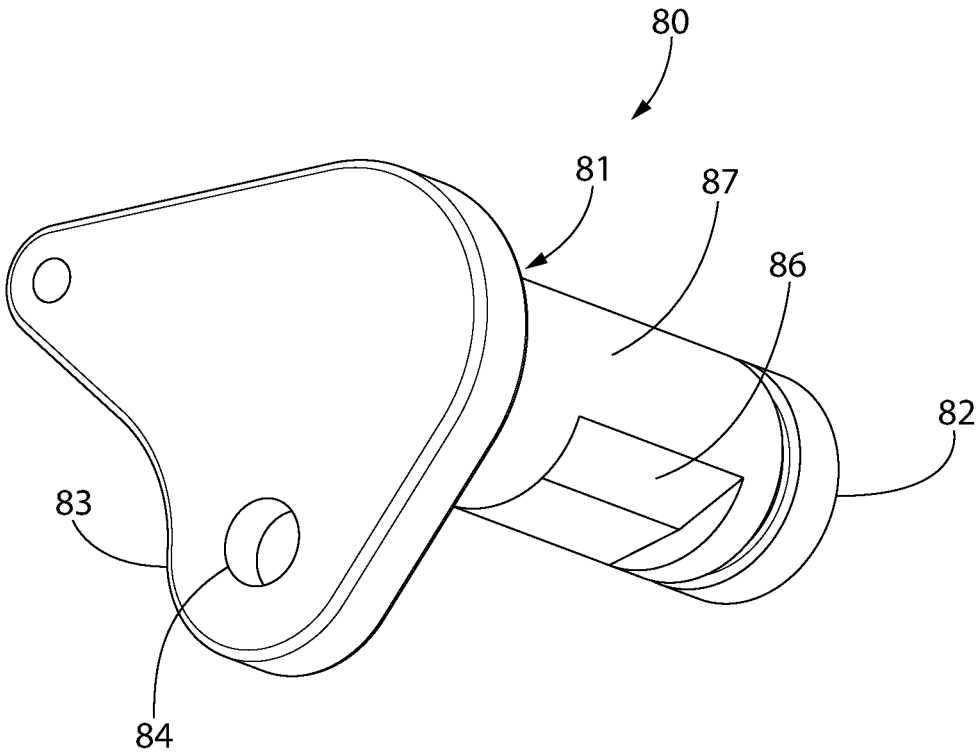
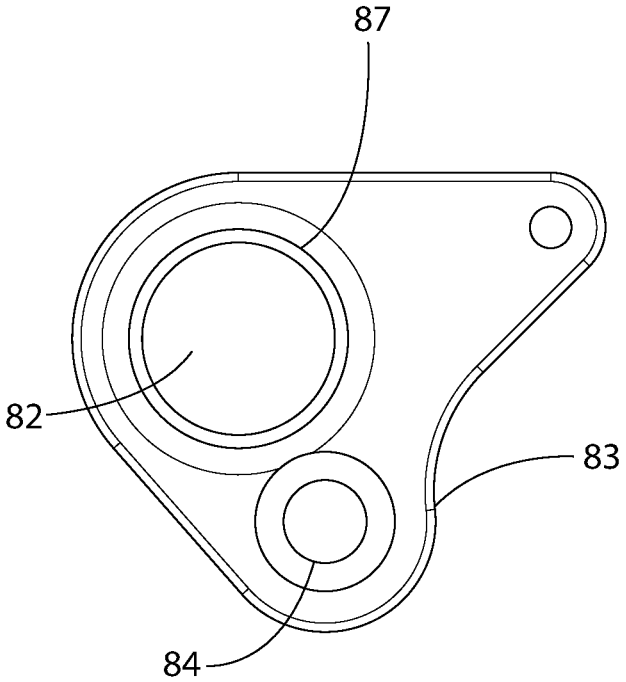


FIG. 22



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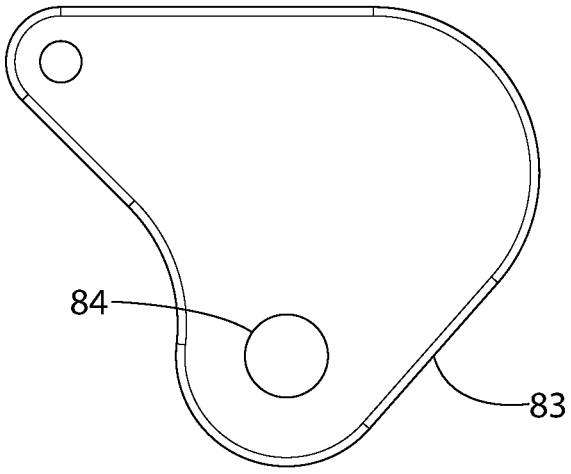

FIG. 24

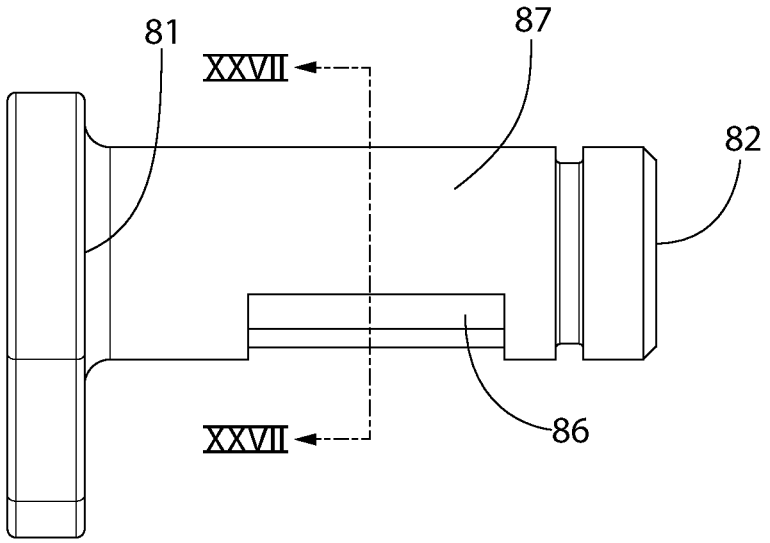

FIG. 25

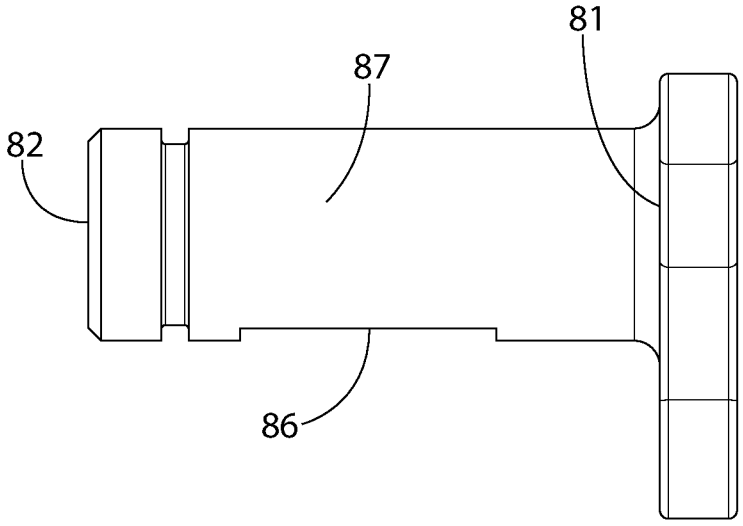

FIG. 26

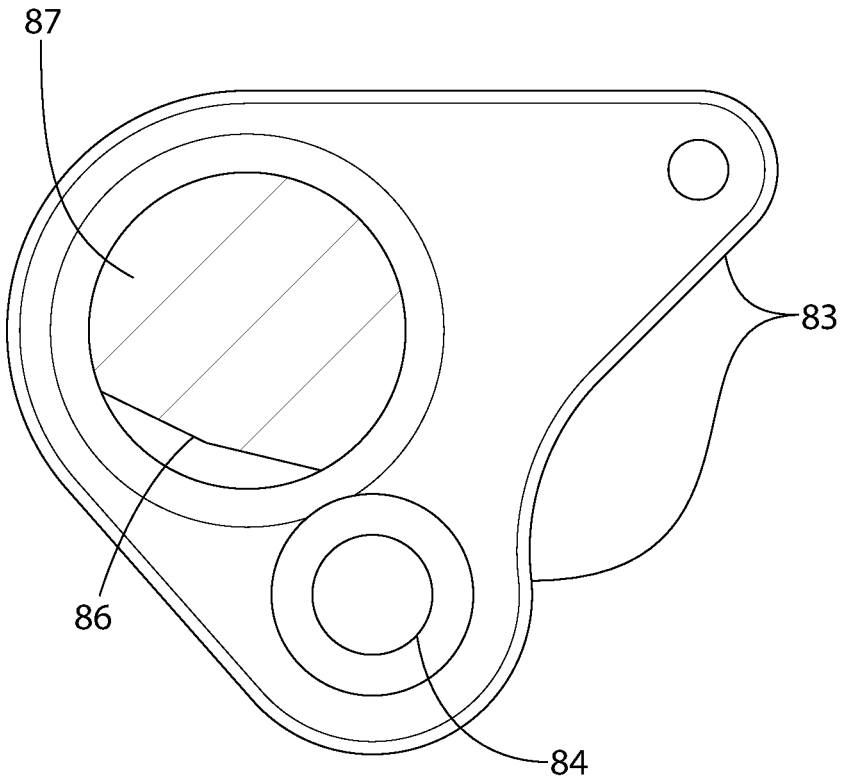

FIG. 27

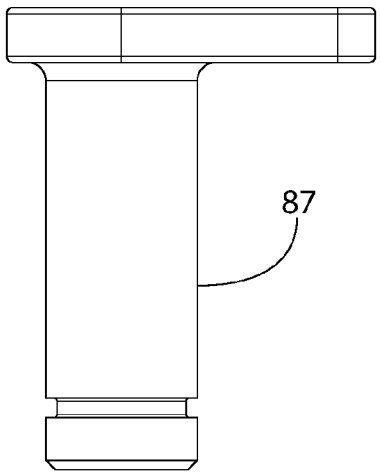

FIG. 28

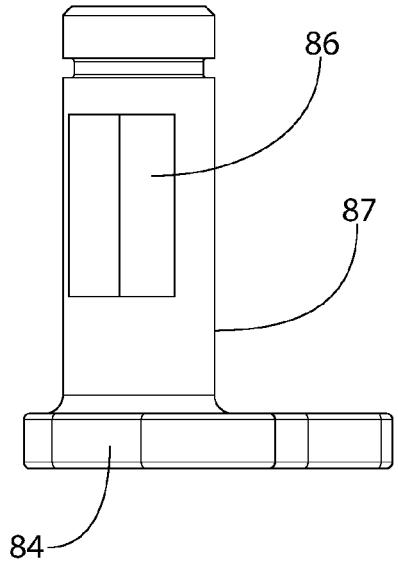

FIG. 29

SAFETY MECHANISM FOR FIREARM

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims the benefit of priority to U.S. Provisional Application Ser. No. 62/096,981 filed Dec. 26, 2014, the entirety of which is incorporated herein by reference.

BACKGROUND

The present invention generally relates to firearms, and more particularly to a safety selector mechanism suitable for a bolt-action firearm such as a rifle.

On some firearms it is desirable for ergonomic considerations, design constraints, aesthetics, or other reasons, to position a safety selector that controls the firing mode so that it must be contained within the stock assembly or another component that can be separated from the receiver or action. Pistol grips as popularized by the AR-15 genre of rifles (adopted by the U.S. military as the M16 rifle) have been commonly used on other types of modern firearms; often on rifles that were not originally designed for pistol grips. On bolt action rifles modified to add a pistol grip, the safety selector may be left in its original location typically alongside the back of the bolt or on top of the buttstock behind the bolt, which is not easily accessed when holding onto a pistol grip instead of cradling the stock. Hence, while acceptable for bolt action rifles without a pistol grip, this top-mounted safety selector location is inconvenient.

On firearms like the AR-15, where all of the fire-control components are contained in the lower receiver, the safety selector remains in the same relative position and does not hinder disassembly. If the fire-control group of components is connected to the receiver or action, while the safety selector is attached or contained within another component, it may be difficult to separate these components without disassembling additional rifle parts. This is especially true for rotating safety selectors, like used in AR-15 type rifles, where the cross shaft of the safety interacts with or intersects part of the fire-control group to block the firing mechanism. Optimally, the safety mechanism and selector switch should be strategically located to minimize the number of components which need to be disassembled to access to the firearm's firing mechanism.

Accordingly, an improved and more conveniently located safety selector design is desired for rifles with pistol grips other than the AR-15 rifle platform.

SUMMARY

A firearm according to the present disclosure includes a safety mechanism which allows the safety selector to be mounted in a removable stock component separate from the firing mechanism assembly mounted in a trigger housing, but can still be easily separated without additional disassembly of safety or fire-control components. In one implementation, the safety selector allows selection of a "safe" firing mode in which the firing mechanism is disabled and a "fire" firing mode in which the firing mechanism is enabled to discharge the firearm. The concept also prevents the stock component and trigger housing from being separated from the receiver unless the safety selector is in the "safe" position. When designed around an AR-15 compatible safety shaft, like the design described herein, the safety selector can be installed for either left or right hand operation.

Unlike an AR-15 rifle where the safety selector provides the direct physical restraint for the trigger, the present safety mechanism uses another separate component in the form of a safety shaft to interact directly with the trigger. The safety shaft, still operated by the safety selector, is located forward of the trigger in one embodiment to selectively engage or disengage the trigger; the trigger's movement being arrested when engaged to disable the trigger-actuated firing mechanism. The safety selector is mounted rearward of the trigger on the lateral side of the firearm in the same convenient position as used on an AR-15 rifle. However, the physically separated safety shaft and safety selector are mechanically coupled via a mechanical linkage such that rotating the selector concomitantly rotates and operates the shaft. A pistol grip may be provided which takes advantage of the side-mounted safety selector.

According to one aspect, a firearm with safety mechanism includes: a receiver; a barrel coupled to the receiver and defining a longitudinal axis; a trigger housing detachably coupled to the receiver; a trigger-actuated firing mechanism mounted in the trigger housing and operable to discharge the firearm via a trigger pull; a safety shaft extending transversely through the trigger housing and defining a first pivot axis, the safety shaft rotatable between a blocking position in which the safety shaft disables the firing mechanism and an unblocking position in which the shaft enables the firing mechanism to discharge the firearm; a safety selector comprising a control shaft extending transversely through the trigger housing and defining a second pivot axis, the safety selector mechanically coupled to the safety shaft such that rotation of the safety selector rotates the safety shaft, the safety selector rotatable between a safe position and a fire position; and a selector switch disposed on a first end of the control shaft for operating the safety selector. Rotating the safety selector about the second pivot in a first direction from the safe position to the fire position rotates the safety shaft about the first pivot axis from the blocking position to the unblocking position; and rotating the safety selector about the second pivot axis in a second direction from the fire position to the safe position rotates the safety shaft about the first pivot axis from the unblocking position to the blocking position.

According to another aspect, a trigger housing assembly attachable to a bolt-action firearm includes: a body defining an interior space and longitudinal axis; a firing mechanism disposed at least partially in the interior space, the firing mechanism operable to discharge the firearm via pulling a trigger movably mounted to the body; a safety shaft extending transversely through the trigger housing and defining a first pivot axis, the safety shaft rotatable between a blocking position in which the safety shaft disables the firing mechanism and an unblocking position in which the shaft enables the firing mechanism to discharge the firearm; a downwardly open vertical first slot formed in the body; a rotary cam rotatably disposed in the body proximate to the first slot, the rotary cam comprising a second slot having an open end and a closed end; the rotary cam rotatable between an aligned position in which the first and second slots are in vertical alignment and a misaligned position in which the second slot of the rotary cam is not in vertical alignment with the first slot of the body; a control rod coupling the rotary cam to the safety shaft; and a safety selector comprising a control shaft defining a second pivot axis and elongated selector switch extending radially outward from a first end of the control

shaft for operating the safety selector, the control shaft inserted transversely through the first and second slots of the body and rotary cam respectively, the control forming a locking fit with the rotary cam such that rotating the safety selector concurrently rotates the rotary cam. Rotating the safety selector about the second pivot in a first direction from the safe position to the fire position concurrently rotates the safety shaft about the first pivot axis from the blocking position to the unblocking position; and rotating the safety selector about the second pivot axis in a second direction from the fire position to the safe position concurrently rotates the safety shaft about the first pivot axis from the unblocking position to the blocking position.

A method for operating a safety mechanism of a bolt-action rifle is provided. The method includes: providing a firearm including a longitudinal axis, a receiver, a barrel supported by the receiver, and a trigger housing comprising (1) a trigger-actuated firing mechanism operable to discharge the firearm, (2) a rotary safety selector including a control shaft extending transversely through the trigger housing and a selector switch, (3) a rotary safety shaft extending transversely through the trigger housing and including a blocking surface and an operating surface, and (4) a control rod operably coupling the safety selector to the safety shaft; rotating the safety selector in a first direction to a "safe" rotational position; concurrently rotating the safety shaft in a second rotational direction via the control shaft by rotating the safety selector in the first direction; engaging the blocking surface of the safety shaft with a trigger of the firing mechanism, wherein movement of the trigger is prevented to disable the firing mechanism; rotating the safety selector opposite to the first rotational direction to a "fire" rotational position; concurrently rotating the safety shaft opposite to the second rotational direction via the control shaft by rotating the safety selector opposite to the first rotational direction; disengaging the blocking surface of the safety shaft from the trigger of the firing mechanism; and aligning the operating surface of the safety shaft to the trigger providing clearance such that movement of the trigger is not prevented to enable the firing mechanism.

Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the exemplary embodiments will be described with reference to the following drawings where like elements are labeled similarly, and in which:

FIGS. **1** and **2** are right and left side views respectively of one embodiment of a firearm including a safety mechanism according to the present disclosure;

FIG. **3** is a partial right side view of the firearm showing the firing mechanism components;

FIG. **4** is a partial left side view of the firearm showing the safety selector and pistol grip area of the firearm;

FIG. **5** is a top perspective view of a removable lower assembly or stock of the firearm of FIG. **1**;

FIG. **6** is a partial left side view of the firearm with the lower stock removed;

FIG. **7** is a detailed view taken from FIG. **6**;

FIG. **8** is left perspective view of a removable trigger housing which houses the trigger actuated firing mechanism components;

FIG. **9** is an exploded perspective view thereof;

FIG. **10**A is a left side view thereof associated with the safety selector in a "safe" firing mode position and the safety shaft engaging and preventing movement of the trigger to disable the firing mechanism;

FIG. **10**B is left side cross-sectional view thereof;

FIG. **10**C is a left side cross-sectional view thereof showing portions of the receiver containing additional firing mechanism components which interact with the firing mechanism components of the trigger housing;

FIG. **11**A is a left side view thereof associated with the safety selector in a "fire" firing mode position and the safety shaft disengaging and allowing movement of the trigger to enable the firing mechanism;

FIG. **11**B is left side cross-sectional view thereof;

FIG. **11**C is a left side cross-sectional view thereof showing portions of the receiver containing additional firing mechanism components which interact with the firing mechanism components of the trigger housing;

FIG. **12** is a bottom plan view of the trigger housing showing the safety selector mounted therein;

FIG. **13** is a perspective view of the safety selector;

FIGS. **14** and **15** are left and right side views thereof;

FIGS. **16** and **17** are top and bottom plan views thereof;

FIG. **18** is a transverse cross-sectional view thereof;

FIGS. **19** and **20** are rear and front views thereof;

FIG. **21** is a right perspective view of the safety shaft;

FIG. **22** is a left perspective view thereof;

FIGS. **23** and **24** are right and left side views thereof;

FIGS. **25** and **26** are rear and front views thereof;

FIG. **27** is a transverse cross-sectional view thereof; and

FIGS. **28** and **29** are top and bottom plan views thereof.

All drawings are schematic and not necessarily to scale. Parts given a reference numerical designation in one figure may be considered to be the same parts where they appear in other figures without a numerical designation for brevity unless specifically labeled with a different part number and/or described herein. Parts described herein with respect to certain figures may also appear in other figures. Furthermore, a general reference to a whole figure number (e.g. FIG. **6**) which may include multiple subparts (e.g. FIGS. **6**A, **6**B, etc.) shall be construed as a reference to all of the subparts unless specifically noted otherwise.

DETAILED DESCRIPTION

The features and benefits of the invention are illustrated and described herein by reference to exemplary embodiments. This description of exemplary embodiments is intended to be read in connection with the accompanying drawings, which are to be considered part of the entire written description. Accordingly, the disclosure expressly should not be limited to such exemplary embodiments illustrating some possible non-limiting combination of features that may exist alone or in other combinations of features.

In the description of embodiments disclosed herein, any reference to direction or orientation is merely intended for convenience of description and is not intended in any way to limit the scope of the present invention. Relative terms such as "lower," "upper," "horizontal," "vertical,", "above," "below," "up," "down," "top" and "bottom" as well as derivative thereof (e.g., "horizontally," "downwardly," "upwardly," etc.) should be construed to refer to the orientation as then described or as shown in the drawing under discussion. These relative terms are for convenience of description only and do not require that the apparatus be constructed or operated in a particular orientation. Terms such as "attached," "affixed," "connected," "coupled," "interconnected," and similar refer to a relationship wherein

structures are secured or attached to one another either directly or indirectly through intervening structures, as well as both movable or rigid attachments or relationships, unless expressly described otherwise.

The term "action" is used herein in its conventional sense in the firearm art as meaning the mechanism that loads and ejects shells into/from the firearm and opens and closes the breech (i.e. the area in the receiver between an openable/closeable breech face on the front of the bolt and the rear face of the barrel chamber).

FIGS. **1-4** depict a firearm **20** with safety selector and interlock mechanisms according to the present disclosure. In one non-limiting example illustrated herein, the firearm **20** may be a bolt action rifle.

Referring to FIGS. **1-3**, firearm **20** generally includes a receiver **21**, a trigger housing **22** detachably mounted to the receiver, a barrel **23** supported by the receiver, and optionally a handguard **24** enclosing and circumscribing at least part of the length of the barrel. The barrel includes an open front muzzle end **23***a* and an open rear breech end **23***b* (obscured beneath the handguard) coupled to the front end of the receiver **21** in any suitable manner (e.g. threading, interlocking lugs, barrel or lock nut, etc.). The barrel of rifle **20** defines a longitudinal axis LA and axial direction of the firearm coinciding with the centerline of the barrel **23** and its longitudinal bore formed therein between the muzzle and breech ends **23***a*, **23***b* (not shown) that defines the projectile pathway. Handguard **24** if provided may any type and coupled to the front end of the receiver and/or the barrel.

Firearm **20** further includes a buttstock **30** extending rearward from the receiver **21** for placement against the user's shoulder when aiming the firearm held in a ready-to-fire position to acquire a target. Buttstock **30** may be any type or configuration of buttstock including fixed, adjustable and non-adjustable types, and folding and non-folding types. The invention is not limited by the type of buttstock which may be used.

Firearm **20** further includes a lower assembly or stock **60**, which in one non-limiting embodiment is detachably mounted to the bottom of the receiver **21**. Lower stock **60** includes a front portion **33**, opposing rear portion **34**, trigger guard **31** position to enclose trigger **28**, a pistol grip **27** rearward of the trigger guard, and magazine well **29** forward of the trigger guard. The magazine well is configured and structured to removably detain and latch an insertable box type ammunition magazine via pivotable latch **32** mounted to the lower stock **60** at the rear of the magazine well **29** (best shown in FIG. **3**).

In one non-limiting implementation, there are two mounting points which may be used to secure the lower stock **60** to the receiver **21**. Referring to FIGS. **3**, **5**, and **6**, a front mounting features includes an upwardly open locking recess **130** in lower stock **60** configured with a raised central rib. Recess **130** receives dual laterally spaced mounting lugs **132** projecting downwards from the front portion of receiver **21**. One of the lugs **132** (far or right lug) has a threaded hole and one lug (near or left side) has a clearance hole. When the lower stock **60** is raised into place on the bottom of the receiver **21**, the lugs **132** are positioned on opposite sides of the raised rib central which is received between the lugs. In one configuration, the bottom of the lugs **132** may be convexly rounded and the recess **130** on opposite sides of the central rib may be concavely round by arcuate walls of the lower stock formed at the bottom of the recess (best shown in FIG. **5**). Once the upper is raised into place, a threaded bolt **131** is inserted through hole **99** in the left lateral side **68** of the lower stock **60**, passing through the clearance hole in the near side lug and engaging the threaded hole in the far side lug. When tightened, the lugs **132** are pulled together to compress the central rib in recess **130** of the stock **60** thereby securely holding the stock laterally to the receiver while the bolt **131** also retains the lower stock vertically.

The second rear mounting feature can be seen in FIGS. **3** and **5**. A socket head cap screw or other type threaded fastener **135** is inserted from the back of the firearm through the receiver **21** and lower stock **60**. An axial threaded hole **98** formed in the rear of the lower stock receives the threaded fastener **135** extending through and from a concentrically aligned hole in the receiver which secures the rear end of the lower stock **60** to the receiver. Preferably, this fastener **135** should be secured first, which helps brings the lower into a more consistent position and alignment relative to the receiver **21** and trigger housing **22**, and afterwards the front bolt **131** may next be tightened lastly. However, in other possible lower stock mounting sequences, the front bolt may be secured first before the rear bolt.

The fire control mechanism and safety will now be described.

The receiver **21** supports portions of the trigger-actuated fire control mechanism operable to discharge the firearm **20**. The fire control mechanism includes an axially movable and elongated bolt **25** which may include a bolt handle **25***a* for manually operating the action to form a closed or open breech in relation to the chamber formed at the rear breech end **25***b* of barrel **25** which holds an ammunition cartridge. The bolt **25** is slidably moveable forward/rearward in an axially extending internal cavity **21***a* of receiver **21**. The bolt assembly comprises a slidable striker or firing pin **26** carrier inside the bolt **25** for detonating a chambered cartridge when the firearm is discharged, a main spring **35** which acts to bias the firing pin rearward in a cocked ready-to-fire position, and a cocking piece **36** attached to the rear end of the firing pin (best shown in FIG. **3**). The foregoing firing mechanism components are mounted in and supported by the receiver **21**.

The trigger housing **22** supports the other portions of the firing mechanism which operate together via pulling trigger **28** to release a cocked firing pin **26** for discharging the firearm. Referring to FIGS. **3** and **9**, the trigger housing **22** has a generally rectangular elongated body defining an interior space **90** and various external openings to access the space for housing various firing mechanism components described herein. Trigger housing **22** may be removably attached to the receiver **21** by a variety of mechanical means. In one embodiment, the trigger housing may include a plurality of laterally extending tabs **91** which interlock with mating tabs formed in the underside of the receiver (not shown) to suspend the housing from beneath the receiver. One or more fastener openings **92** may be provided which receive fasteners therethrough to complete securement of the trigger housing **22** to the receiver **21**. In other possible embodiments, fasteners alone may be used to secure the trigger housing to receiver. Other mechanical methods or combinations of methods may also be used. The invention is not limited by the type of means used to detachably secure the trigger housing to the receiver. Preferably, the trigger housing **22** is securely attached to the receiver **21** of the firearm to ensure that the relationship between the sear **38** and the firing pin cocking piece **36** used to hold or release the firing pin **26** is maintained to prevent variable trigger feel and uncontrolled disengagement. The trigger housing **22** cannot be removed without first removing the lower stock **60** assembly from the firearm.

The firing mechanism components supported by the trigger housing **22** includes a dual trigger mechanism including trigger **28** and trigger release member **37** which cooperates with the trigger to release a sear **38**. Trigger **28** is movably mounted to trigger housing **22**. In one non-limiting embodiment as illustrated, the trigger is pivotably mounted to the module about transverse pin **56** which defines a pivot axis of the trigger. The trigger release member **37** is pivotably mounted to the trigger **28** about a second transverse pin **40** which is disposed just rearward of the trigger pin **40**. This defines a separate pivot axis for the release member which is parallel to the trigger's pivot axis. Both the trigger **28** and the trigger release member **37** pivot in forward and rearward axial directions parallel to the longitudinal axis LA, as further described herein.

Trigger **28** has a vertically elongated body including a lower arcuately curved operating end **43** for engaging a user's trigger finger and a vertically elongated upper sear catch protrusion **44** protruding upwards from the operating end. Lateral mounting hole **46** receives transverse pin **56** to pivotably mount the trigger to the trigger housing **22**. Sear catch protrusion **44** includes an upward facing ledge **48** configured and arranged to selectively engage a mating downward facing hook-shaped sear catch **49** formed on the sear **38** for holding the sear in an upright position until the firearm **20** is discharged.

The trigger release member **37** has a vertically elongated flat or plate-like elongate body defining an arcuately curved lower operating end **42** shaped for engaging a user's trigger finger and upper extension **41** protruding upwardly from the operating end. Lateral mounting hole **47** in the release member and mounting hole **61** in the trigger **28** receive transverse pin **40** to pivotably mount the release member to the trigger **28**. The release member **37** is therefore supported by and movable in relation to the trigger. The operating end **42** of release member **37** is slideably received through a vertical slot **45** in curved operating end **43** of the trigger **28**.

Sear **38** has a horizontally elongated body including catch **49** formed on the front side or face, and an upwardly extending and vertically elongated firing pin catch protrusion **50**. Lateral mounting hole **53** receives transverse pin **54** to pivotably mount the sear **38** to the trigger housing **22**. Firing pin catch protrusion **50** defines a rear facing blocking surface **51** which is configured and arranged to abuttingly engage a mating front facing stop surface **52** formed on the cocking piece **36** of the bolt assembly (see, e.g. FIG. **3**). Sear spring **39** biases the sear **38** into an upwards blocking position about pin **54** to force and positively maintain blocking surface **51** against stop surface **52** to prevent the release of the firing pin absent a trigger pull. In one embodiment, spring **39** may be a helical compression spring; however, other types of springs (e.g. torsion) may be used.

Trigger **28** in turn is biased into an upwards position about pin **56** by trigger spring **55**. In one embodiment, spring **55** may be a helical compression spring; however, other types of springs (e.g. torsion) may be used. Spring **55** acts on the vertical front side or surface **66** of the sear catch protrusion **44** of trigger **28** at a point above pin **56**. This biases the trigger rearwards towards sear **38** which is mounted behind the sear catch protrusion **44** in the trigger housing **22**. This in turn also forces the ledge **48** into positive engagement with the sear catch **49** on sear **38** for holding the sear in the upwards blocking position with a cocked firing pin **26**. Spring **55** may be obliquely arranged to the longitudinal axis LA of firearm **20** to provide a line of action (extending along the axial centerline of the spring between its ends) which intersects the sear. This provides positive engagement of the ledge **48** on the trigger sear catch protrusion **44** with the sear catch **49**. The sear catch protrusion **44** of trigger **28** is pivotable forwards about pin **56** to disengage and release the firing pin **26**, as further described herein.

A spring **57** is disposed between and has opposing ends which act against both the trigger **28** and trigger release member **37**, as seen in FIG. **3**. The spring **57** is located above transverse pins **40** and **56** to bias the upper portions of the trigger and trigger release member apart. This in turn biases the curved lower operating end **42** of the trigger release member **37** to protrude forward beyond the curved lower operating end **43** of trigger **28** to maintain the release member. It bears noting that spring **57** is typically smaller in size than and has a lower spring force than trigger spring **55** so that the rearward spring force of spring **55** dominates and maintains positive engagement between the sear catch protrusion **44** and firing pin **26**.

The firearm **20** may be discharged in the following manner. Referring to FIG. **3**, the firing mechanism is shown in a ready-to-fire position. With addition reference to FIG. **9**, the bolt **25** is forward in a closed breech position in battery with the barrel **23** wherein a cartridge is chambered in the breech end **23***b*. Firing pin **26** is held rearward in a cocked position by sear **38** via engagement between blocking and stop surfaces **51**, **52** of the sear and cocking piece **36** of the bolt respectively. The sear **38** is in the upwards blocking position being held there by the trigger release member **37** which similarly is in its upwards blocking position by spring **55**. Trigger **28** is in a substantially vertical non-pulled position.

To discharge the firearm, a user first pulls the exposed portions of the trigger **28** (via lower operating end **43**) and trigger release member **37** (via lower operating end **42**) rearward. It should be noted that the user initially engages the lower operating end **42** of the trigger release member **37** which protrudes forward of the trigger **28** in the normal un-pulled position (see, e.g. FIGS. **3**, **7**, and **8**). The trigger release member moves rearward compressing spring **57** against the sear catch protrusion **44** which remains stationary at this stage until the front of operating end **42** of the trigger release member **37** is flush with the front of the operating end **43** of the trigger **28**. It bears noting that trigger block pin **132** (see, e.g. FIG. **10**B) blocks the trigger movement until the trigger release is moved.

Continued pulling of both the trigger **28** and trigger release member **37** rearward together (counter-clockwise in FIG. **3**) now rotates the upper extension **41** and sear catch protrusion **44** of the trigger release member and trigger respectively forward (clockwise in FIG. **3**) against the rearward biasing force of spring **55**. The ledge **48** on the trigger sear catch protrusion **44** disengages the sear catch **49** on sear **38**. The sear **38** rotates downwards (clockwise in FIG. **3**) to disengage the sear blocking surface **51** from the firing pin stop surface **52** on the cocking piece **36**. The firing pin **26** is thus released and moves forward assisted by main spring **35** to strike its forward end against the chambered cartridge which is detonates to discharge the firearm.

According to one aspect of the invention, a mechanical safety mechanism is provided which acts to selectively arrest and disable the foregoing firing mechanism. This is intended to prevent inadvertent discharge of the firearm even if a trigger pull is attempted while the safety is "on." Advantageously, the present safety mechanism provides for a bolt action rifle the convenience of a side-mounted AR-15 style safety selector with pistol grip both traditionally found only on conventional AR-15 semi-automatic action type rifles.

Referring to FIGS. **6-11** inclusively, a safety mechanism in one embodiment generally comprises a safety shaft **80**, a safety selector **70**, and a safety operating linkage such as control rod **100** operably coupling the shaft and selector together. The control rod operates and controls the position of the safety shaft **80** via rotating the safety selector **70**, as further described herein. Both the safety shaft and safety selector are mounted to the trigger housing **22**.

The control rod **100** may a wire-form linkage to allow actuation of the safety shaft **80** from a different location or even a different amount of rotation. The safety shaft **80** in the illustrated embodiment is disposed forward of trigger **28** and the safety selector **70** is disposed rearward of the trigger in the trigger housing. This linkage system allows the safety selector position to be less critical because it is not directly contacting the trigger to arrest its movement. This is important because when the safety selector is connected to a different component than the trigger housing, very tight tolerances would be required to maintain a close relative position.

The safety shaft **80** extends transversely through the trigger housing **22** between right and left opposing lateral sides **64**, **65** of the housing and defines a pivot axis. With additional reference to FIGS. **21-29** showing details of the safety shaft **80**, the shaft has a generally cylindrical shape and includes opposing ends **81**, **82**. A diametrically enlarged operating protrusion **83** extends radially from a first end **81** of the safety shaft in a direction perpendicular to the length of the shaft for coupling to the control rod **100**. In one embodiment, protrusion **83** may have an oblong or lobed shape as illustrated. An aperture **84** is formed in protrusion **83** which receives a first hook-shaped curved end **101** of control rod **100** (see also FIGS. **8** and **9**). Because aperture **84** is disposed radially distant and apart from the safety shaft **80**, this arrangement provides added leverage to easily rotate the shaft using rod **100** against the biasing force spring **85**. Spring **85** may be a torsion spring in one embodiment and biases the safety shaft **80** into two rotational positions shown in FIGS. **10**A and **11**A. One end of spring **85** engages the trigger housing as shown and the other end engages hole **133** formed in protrusion **83** (see, e.g. FIG. **21**). Spring **85** helps stabilize rotational motion of the safety shaft. Other types of springs may be used in other embodiments.

The safety shaft **80** is rotatable between a blocking position in which the safety shaft disables the firing mechanism and an unblocking position in which the shaft enables the firing mechanism to discharge the firearm. Safety shaft **80** comprises a substantially flat operating surface **86** and a circumferentially adjoining arcuate blocking surface **87** formed by full diameter portions of the shaft on either side of the flat. The flat operating surface **86** is rotatable in radial position with the safety shaft. The term "substantially flat" indicates that although the operating surface **86** may be considered flat with respect to the arcuate blocking surface **87**, the operating surface may in fact have a compound shape with portions of the surface **86** varying slightly in angularity to other portions of the surface **86** such as by 10 degrees or less; however, the overall profile of the operating surface may still be considered flat. The "flatness" of the surface will be dictated in part by configuration of the trigger **28** as explained below.

To enable the firing mechanism, the flat operating surface **86** is rotatable to a position arranged approximately parallel to a front surface **66** of the trigger **28** when the safety shaft is in the unblocking position. This provides a horizontal gap or clearance between the front surface **66** and flat operating surface **86** which allows pivotable movement of the trigger **28** sufficient to release the sear **38** and discharge the firearm by disengaging the cocking piece **36** of the firing pin **26**. This corresponds to the rotational "fire" position of the safety selector **70**.

To disable the firing mechanism, the safety shaft **80** is rotated to engage the arcuate blocking surface **87** with the front surface **66** of the trigger **28** when the safety shaft is in the blocking position. This prevents pivotable movement of the trigger sufficient to release the sear **38** and discharge the firearm. Movement of the trigger-actuated firing mechanism to discharge the firearm is therefore arrested. This corresponds to the rotational "safe" position of the safety selector **70**.

The safety selector **70** will now be further described. With additional reference now to FIGS. **12-20** showing details of the safety selector **70**, the safety selector comprises a cylindrical control shaft **71** which extends transversely through the trigger housing **22** between the right and left opposing lateral sides **64**, **65** of the housing when positioned therein. The control shaft **71** defines opposing ends **72** and **73**, and a pivot axis of the safety selector **70**. In one embodiment, the pivot axis of the safety selector **70** is located lower in trigger housing **22** than the pivot axis of the safety shaft **80**. An elongated selector switch **74** is disposed on a first end **73** of the shaft for operating the safety selector via a user's finger or thumb. The selector switch **74** extends radially in a direction perpendicular to the length of the control shaft **71** and may have any suitable shape and a surface texture selected to facilitate grasping by a user in some embodiments (e.g. ridges, knurling, etc.).

In one embodiment, the selector switch **74** may further comprise a firing mode indicator **79** adjoining end **73** of the control shaft **71**. The indicator **79** may be circular in one embodiment and have a diameter the same as, or in a preferred embodiment larger than the diameter of the adjoining control shaft. An arrow **75** may be formed on the firing mode indicator **79** which is rotatable to point to indicia comprising for example "safe" and "fire" which optionally may be engraved in or otherwise marked on the lower stock **60** (e.g. lateral side **68**) adjacent to the indicator. Other firing modes and indicia may be provided.

In one embodiment, the safety selector **70** is mounted in the lower stock **60** and supported independently of the trigger housing **22** such that removal of the lower stock from the firearm **20** and receiver **21** removes the safety selector with the lower stock without removing the safety selector from the lower stock or disassembling the safety or firing mechanism components. FIG. **5** shows this arrangement in the lower stock **60** with the control shaft **71** extending transversely and being received through apertures in opposing lateral right and left sides **67**, **68** of the stock. In one embodiment, the end **72** of the control shaft **71** opposite the selector switch **74** penetrates lateral side **67** of the lower stock **60** and is exposed for viewing by the user. End **72** may be provided with firing mode indicia **77** (e.g. line, shape, etc.) which aligns with markings/indicia (e.g. "safe" and "fire") emplaced on the right lateral side **67** of the lower stock **60** to signal whether the safety selector **70** is in one of the two operating positions. Other firing modes and indicia may be provided.

It should be noted that the lateral sides **67**, **68** of the lower stock **60** are spaced apart defining an axially elongated internal cavity **69** which is upwardly open to receive the trigger housing **22** therein when the lower stock is attached to the receiver **21**.

According to another aspect, another benefit of the present design described here is that the safety selector **70** is held

in place by the trigger housing, and not with a spring and plunger like the selector in an AR-15 rifle. Not only does this eliminate parts, but it makes it possible to reverse a standard AR-15 selector to provide the same function with the safety lever on either the left or right side. Eliminating the drag from the spring loaded plunger also allows the safety to rotate more smoothly and reduce the likely hood of the selector coming to rest in a partially engaged or disengaged position.

FIGS. **12** and **13** are referenced now to describe this interface between the safety selector **70** and trigger housing **22**. The control shaft **71** of the safety selector **70** may have a stepped configuration defining a reduced diameter central portion formed by spaced apart shoulders on shaft. A pair of inward facing and opposing abutment surfaces **96** is formed by the stepped shaft **71**. Abutment surfaces **96** abuttingly engages mating outward facing abutment surfaces **97** formed on each side of the vertical slot **103** in the housing. In this arrangement, the safety selector control shaft **71** can only be downwardly withdrawn from the slot **103** in the trigger housing **22**, and not laterally removed therefrom.

Once the lower stock **60** is separated from the receiver **21**, the safety selector **70** can be removed from the lower stock just be sliding it laterally outwards. While installed on the receiver **21**, however, the trigger housing **22** prevents the selector from sliding laterally out of the stock or trigger housing. If an ambidextrous style selector is used, with a lever or switch **74** on each side which may be provided in some implementations, it would first have to be disassembled for removal from the lower assembly.

With reference now to FIGS. **12-20**, the control shaft **71** of the safety selector **70** further comprises a flat surface **76** and a circumferentially adjoining arcuate surface **78** formed on either side of the flat in the reduced diameter central portion of the shaft. The flat surface **76** is rotatable in position with rotation of the safety selector control shaft **71** via the selector switch **74**. In one embodiment, the portion of the control shaft **71** including the flat surface **76** may have a generally semi-circular shape in transverse cross section, as illustrated in FIG. **18**. This shape lockingly mates with a complementary configured downwardly open vertical slot **111** formed in a rotary cam **110**.

Referring to FIGS. **3** and **8-12**, rotary cam **110** cooperates with the safety selector **70** and control rod **100** to impart rotational movement to the safety shaft **80** which is inaccessible to a user when the lower stock **60** is attached to the receiver **21**. The rotary cam operates to convert rotary motion of the selector switch **74** and control shaft **71** coupled thereto into substantially linear axial motion of the control rod **100** which moves the safety shaft **80** between the blocking and unblocking positions by rotating the safety selector **70**. Advantageously, this permits placement of the safety selector **70** rear of the trigger **28** on the left lateral side **68** of the lower stock for convenient use with pistol grip **27** formed on the lower stock.

The rotary cam **110** is mounted in an upwardly open recess **112** formed near the rear end **105** of the trigger housing **22** (see, e.g. FIGS. **8**, **10**B, **11**B). For point of reference, the safety shaft **80** is disposed near the front end **104** of the housing **22**. Recess **112** has an axial width which is slightly but not overly larger than the diameter of the rotary cam body to allow the cam to be inserted downwards into the recess when the safety mechanism components are installed in the trigger housing **22**. The recess **112** may have a U-shape in transverse cross section and circumscribes a downwardly open vertical slot **103** formed in the trigger housing **22**. The slot **103** may extend transversely through both the right and left lateral sides **64**, **65** of the housing. The lower portions of the recess **112** on each side of the slot **103** in trigger housing **22** are bounded by bottom arcuate walls **95** which complement and engage the circular shape of the body of the rotary cam **110** on each side of slot **111**. The rotary cam **110** is seated and rotatable on the arcuate walls **95** when fully installed in the trigger housing. The lower end of the recess **112** is smaller than the diameter of the rotary cam **110** so that the cam cannot fall through the vertical slot **103** in the trigger housing **22**.

Rotary cam **110** has a generally flat disk-like shape which is substantially but not perfectly circular in one embodiment as shown. In other embodiments, the shape may be perfectly circular. Rotary cam **110** has a downwardly open vertical slot **111** for upwardly receiving the safety selector control shaft **71** and an aperture **113** which receives a second hook-shaped curved end **102** of control rod **100** which is coupled thereto. Access through the trigger housing **22** for end **102** of the control rod to engage the aperture **113** of the rotary cam **110** may be provided through an arcuate slot **114** formed in the left lateral side **65** of the housing. The arcuate slot **114** is located to follow the arcuate path of the curved end **102** of the control rod **100** as the safety selector **70** is rotated.

The control shaft **71** of the safety selector **70** is removably received in both of the mating downwardly open slots **103**, **111** disposed in the trigger housing **22** and the rotary cam **110**, respectively. Slots **103** and **111** may have similar heights and axial widths which complement and are preferably slightly larger than the diameter of the safety selector control shaft **71** sufficient to allow both insertion and rotation of the shaft when positioned therein. Slot **111** of the rotary cam **110** has an open bottom end and a closed top end with a shape complementary to the shape semi-circular shape of the portion of the control shaft **71** containing the flat surface **76**. Accordingly, the top end of slot **111** has a mating flat surface **93** and arcuate surface **94** (see, e.g. FIGS. **9**, **10**B, **11**B). This provides a relatively tight interlocking fit and engagement between the control shaft **71** and rotary cam **110** such that rotating the shaft **71** concomitantly rotates the rotary cam.

The safety mechanism is operated in the following manner. Safety selector **70** is first assumed to be in the downward "fire" position shown in FIGS. **11**A-C. The selector switch **74** is thus oriented obliquely to the longitudinal axis LA. In one embodiment, the selector switch **74** may be disposed at approximately 45 degrees to the longitudinal axis. The rotary cam **110** is oriented so that the lower rear quadrant obstructs the vertical slot **103** of the trigger housing **22**. The rear curved end **102** of the control rod **100** is positioned at the rear of arcuate slot **114**. The safety shaft **80** is in the unblocking position with the flat operating surface **86** of the positioned parallel to and facing the front surface **66** of the trigger **28**. When the trigger is pulled, there is sufficient clearance between the safety selector **70** and front surface **66** of trigger **28** to allow the trigger sear catch protrusion **44** to move and release the sear **38** and firing pin **26** for discharging the firearm.

To activate the safety, the user moves and rotates the selector switch **74** upwards (counter-clockwise) to the horizontal "safe" position parallel to longitudinal axis LA as shown in FIGS. **10**A-C. This concomitantly rotates the control shaft **71** of the safety selector **70** counter-clockwise. The rotary motion of the safety selector **70** moves or translates the control rod **100** axially forward. The curved end **102** of the control rod moves forward in turn to the front of the arcuate slot **114**. The rotary cam **110** rotates counter-

clockwise with the safety selector control shaft **71** such that the vertical slot **111** of the cam becomes vertically aligned with and approximately parallel to slot **103** of trigger housing **22**. This would allow removal of the lower stock **60** from the receiver **21** if the firearm **20** were to be disassembled at this point, as already explained herein.

Counter-clockwise rotation of the safety selector **70** and accompanying forward movement of the control rod **100** in turn simultaneously rotates the safety shaft **80** clockwise (see again FIGS. **11**A-C). The safety shaft **80** is now in the blocking position such that the flat operating surface **86** of the shaft has rotated forward and the arcuate blocking surface **78** has rotated rearward into engagement with the front surface **66** of the trigger **28**. When a trigger pull is attempted, there no longer is sufficient clearance between the safety selector **70** and front surface **66** of trigger **28** to allow the sear catch protrusion **44** on the trigger to release the sear **38** and firing pin **26** for discharging the firearm. Instead, pivotal movement of the trigger is arrested, thereby disabling the firing mechanism.

The vertical slot **111** of the rotary cam **110** is rotatable in orientation with respect to the vertical slot **103** of the trigger housing **22** which remains stationary and fixed in position when mounted to the receiver **21**. In another aspect of the invention, relative rotation between the rotary cam **110** and trigger housing **22** advantageously forms an interlock mechanism which prevents removal of the lower housing **60** from the receiver **21** when the safety selector **70** is in the "fire" position. The safety selector control shaft **71** is captured by the rotary cam **110** and the trigger housing **22**, thereby preventing the lower assembly from being removed. While a firearm should always be unloaded before disassembly as dictated by responsible handling procedures, this mechanism is beneficial in that it ensures the safety of the firearm is engaged before the lower stock **60** can be removed and the trigger assembly is exposed. It also prevents the firearm from being re-assembled with the safety in the fire position.

When the safety selector **70** is in the "safe" position shown in FIGS. **10**A-C, the vertical slots **103**, **111** of the trigger housing **22** and rotary cam **110** are vertically aligned and fully open to at least the full diameter of the control shaft **71** of the safety selector. This allows the control shaft and safety selector **70** to be withdrawn downwards and removed from the slots **103**, **111** with the lower stock **60** (in which the safety selector is rotatably mounted as shown in FIG. **4**) to exposed the trigger housing **22** and trigger mechanism. Conversely when the safety selector **70** is in the "fire" position shown in FIGS. **11**-C, the vertical slots **103**, **111** of the trigger housing **22** and rotary cam **110** are no longer vertically aligned and fully open to at least the full diameter of the control shaft **71** of the safety selector. The lower rear quadrant of the rotary cam now protrudes partially into and obstructs the slot **103** of the trigger housing **22** by a sufficient amount to prevent the control shaft **71** from passing downwards therethrough. Rotary cam slot **111** is no longer vertically aligned with but rather obliquely orientated to slot **103** of the trigger housing which traps the control shaft **71** of the safety selector **70** in the cam. This prevents the control shaft and safety selector **70** from being withdrawn downwards and removed from the slots **103**, **111** when in the "fire" position so that the lower stock **60** cannot now be detached from the receiver **21**, thereby forming an interlock mechanism.

While the foregoing description and drawings represent exemplary embodiments of the present disclosure, it will be understood that various additions, modifications and substitutions may be made therein without departing from the spirit and scope and range of equivalents of the accompanying claims. In particular, it will be clear to those skilled in the art that the present invention may be embodied in other forms, structures, arrangements, proportions, sizes, and with other elements, materials, and components, without departing from the spirit or essential characteristics thereof. In addition, numerous variations in the methods/processes described herein may be made within the scope of the present disclosure. One skilled in the art will further appreciate that the embodiments may be used with many modifications of structure, arrangement, proportions, sizes, materials, and components and otherwise, used in the practice of the disclosure, which are particularly adapted to specific environments and operative requirements without departing from the principles described herein. The presently disclosed embodiments are therefore to be considered in all respects as illustrative and not restrictive. The appended claims should be construed broadly, to include other variants and embodiments of the disclosure, which may be made by those skilled in the art without departing from the scope and range of equivalents.

What is claimed is:

1. A firearm with safety mechanism, the firearm comprising:

a receiver;

a barrel coupled to the receiver and defining a longitudinal axis;

a trigger housing detachably coupled to the receiver;

a trigger-actuated firing mechanism mounted in the trigger housing and operable to discharge the firearm via pulling a trigger;

a safety shaft extending transversely through the trigger housing and defining a first pivot axis, the safety shaft rotatable between a blocking position in which the safety shaft disables the firing mechanism and an unblocking position in which the shaft enables the firing mechanism to discharge the firearm;

a safety selector comprising a control shaft extending transversely through the trigger housing and defining a second pivot axis, the safety selector mechanically coupled to the safety shaft such that rotation of the safety selector rotates the safety shaft, the safety selector rotatable between a safe position and a fire position; and

a selector switch disposed on a first end of the control shaft for rotating the safety selector;

wherein rotating the safety selector about the second pivot in a first direction from the safe position to the fire position rotates the safety shaft about the first pivot axis from the blocking position to the unblocking position; and

wherein rotating the safety selector about the second pivot axis in a second direction from the fire position to the safe position rotates the safety shaft about the first pivot axis from the unblocking position to the blocking position.

2. The firearm according to claim **1**, further comprising:

a rotary cam rotatably mounted in the trigger housing, the rotary cam lockingly engaged by the control shaft of the safety selector; and

an axially elongated control rod coupling the safety selector to the safety shaft;

wherein the rotary cam converts rotary motion of the selector switch to linear motion of the control rod which moves the safety shaft between the blocking and unblocking positions by rotating the safety selector.

3. The firearm according to claim 2, wherein:
the control shaft of the safety selector is removably received in mating downwardly open slots disposed in the trigger housing and the rotary cam,
wherein when the rotary cam is in a first rotational position, the slot in the rotary cam is in parallel alignment with the slot in the trigger housing to form a vertical withdrawal path which permits downward removal of the control shaft and safety selector from the trigger housing; and
wherein when the rotary cam is in a second rotational position, the slot in the rotary cam is arranged obliquely to the slot in the trigger housing such that the rotary cam obstructs the vertical withdrawal path which prevents downward removal of the control shaft and safety selector from the trigger housing.

4. The firearm according to claim 3, wherein the control shaft of the safety selector comprises opposing abutment surfaces arranged to engage mating abutment surfaces formed on the trigger housing, the abutment surfaces on the safety selector and trigger housing acting in concert to prevent lateral removal of the safety selector from the trigger housing.

5. The firearm according to claim 2, wherein the safety shaft further comprises an oblong operating protrusion extending radially from a first end of the safety shaft, a first end of the control rod being coupled to the operating protrusion and a second end of the control rod being coupled to the rotary cam.

6. The firearm according to claim 5, wherein the safety shaft is positioned forward of the trigger and the safety selector is positioned rearward of the trigger.

7. The firearm according to claim 6, wherein:
the safety shaft comprises a substantially flat operating surface and a circumferentially adjoining arcuate blocking surface,
the operating surface being arranged parallel to a front side of the trigger when the safety shaft is in the unblocking position to provide clearance which allows pivotable movement of the trigger for discharging the firearm; and
the arcuate blocking surface engages the front side of the trigger when the safety shaft is in the blocking position to prevent pivotable movement of the trigger.

8. The firearm according to claim 1, wherein the safety shaft directly engages the trigger to prevent pivotable movement thereof when the safety shaft is in the blocking position.

9. The firearm according to claim 1, further comprising:
a lower stock detachably mounted to the receiver;
the safety selector mounted transversely in the lower stock and rotatably supported independently of the trigger housing such that removal of the lower stock removes the safety selector therewith.

10. The firearm according to claim 9 wherein the control shaft of the safety selector further extends transversely through the lower stock between opposing first and second lateral sides, the selector switch located on the exterior of the first lateral side of the lower stock for operational access.

11. The firearm according to claim 10, wherein a second end of the control shaft opposite the selector switch extends through the second lateral side and is exposed for viewing.

12. The firearm according to claim 11, wherein the second end includes indicia for verifying whether the safety selector is in the safe or fire position.

13. The firearm according to claim 9, wherein the lower stock includes a pistol grip.

14. The firearm according to claim 1, further comprising:
a manually operated bolt axially movable forward and rearward in the receiver, the bolt including a spring-biased firing pin and a cocking piece coupled to the firing pin;
a sear pivotably engaged between the trigger and cocking piece, the sear pivotable between a blocking position engaging the cocking piece to hold the firing pin in a rearward cocked position, and a non-blocking position in which the sear disengages and releases the firing pin via pivotable movement of the trigger to detonate a cartridge chambered in the barrel.

15. The firearm according to claim 14, wherein the safety shaft disables the firing mechanism by engaging the trigger to prevent pivotable movement thereof to release the sear when the safety shaft is in the blocking position.

16. The firearm according to claim 1, wherein the safety selector is mechanically coupled to the safety shaft by an axially elongated control rod.

17. The firearm according to claim 16, further comprising a diametrically enlarged operating protrusion extending radially from a first end of the safety shaft in a direction perpendicular to the safety shaft, a front end of the control rod coupled to the operating protrusion.

18. A trigger housing assembly attachable to a bolt-action firearm, the trigger housing comprising:
a body defining an interior space and longitudinal axis;
a firing mechanism disposed at least partially in the interior space, the firing mechanism operable to discharge the firearm via pulling a trigger movably mounted to the body;
a safety shaft extending transversely through the trigger housing and defining a first pivot axis, the safety shaft rotatable between a blocking position in which the safety shaft disables the firing mechanism and an unblocking position in which the shaft enables the firing mechanism to discharge the firearm;
a downwardly open vertical first slot formed in the body;
a rotary cam rotatably disposed in the body proximate to the first slot, the rotary cam comprising a second slot having an open end and a closed end;
the rotary cam rotatable between an aligned position in which the first and second slots are in vertical alignment and a misaligned position in which the second slot of the rotary cam is not in vertical alignment with the first slot of the body;
a control rod coupling the rotary cam to the safety shaft; and
a safety selector comprising a control shaft defining a second pivot axis and elongated selector switch extending radially outward from a first end of the control shaft for operating the safety selector, the control shaft inserted transversely through the first and second slots of the body and rotary cam respectively, the control shaft forming a locking fit with the rotary cam such that rotating the safety selector concurrently rotates the rotary cam;
wherein rotating the safety selector about the second pivot in a first direction from the safe position to the fire position concurrently rotates the safety shaft about the first pivot axis from the blocking position to the unblocking position; and
wherein rotating the safety selector about the second pivot axis in a second direction from the fire position to the safe position concurrently rotates the safety shaft about the first pivot axis from the unblocking position to the blocking position.

19. The trigger housing according to claim 18, wherein first and second pivot axes are parallel to each other and transversely oriented to the longitudinal axis.

20. The trigger housing according to claim 18, wherein a rear quadrant of rotary cam at least partially obscures the first slot of the body when the rotary cam is in the misaligned position.

21. The trigger housing according to claim 18, wherein the control shaft of the safety selector is vertically removable from the first and second slots when rotary cam is in the aligned position, and the lower quadrant prevents the control shaft of the safety selector from being vertically removable from the first and second slots when the rotary cam is in the misaligned position.

22. The trigger housing according to claim 21, wherein the safety selector is rotatably supported independently of the trigger housing in a lower stock detachably mounted to the receiver, the safety selector being removable with the lower stock by vertically removing the safety selector from the first and second slots.

23. The trigger housing according to claim 18, wherein the rotary cam has a circular shape and is rotatably disposed in a recess within the body which is bounded by bottom arcuate walls on each side of the first vertical slot.

24. A method for operating a safety mechanism of a firearm, the method comprising:

providing a firearm including a longitudinal axis, a receiver, a barrel supported by the receiver, and a trigger housing comprising (1) a trigger-actuated firing mechanism operable to discharge the firearm, (2) a rotary safety selector including a control shaft extending transversely through the trigger housing and a selector switch, (3) a rotary safety shaft extending transversely through the trigger housing and including a blocking surface and an operating surface, and (4) a control rod operably coupling the safety selector to the safety shaft;

rotating the safety selector in a first direction to a "safe" rotational position;

concurrently rotating the safety shaft in a second rotational direction via the control shaft by rotating the safety selector in the first direction;

engaging the blocking surface of the safety shaft with a trigger of the firing mechanism, wherein movement of the trigger is prevented to disable the firing mechanism;

rotating the safety selector opposite to the first rotational direction to a "fire" rotational position;

concurrently rotating the safety shaft opposite to the second rotational direction via the control shaft by rotating the safety selector opposite to the first rotational direction;

disengaging the blocking surface of the safety shaft from the trigger of the firing mechanism; and

aligning the operating surface of the safety shaft to the trigger providing clearance such that movement of the trigger is not prevented to enable the firing mechanism.

25. The method according to claim 24, further comprising a rotary cam disposed in the trigger housing that operably couples the control rod to the safety selector, the rotary cam locking engaged with the control shaft of the safety selector such that the rotary cam is rotatable with rotation of the safety selector.

26. The method according to claim 24, wherein the firearm includes a pistol grip.

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